

DEPARTMENT OF TRANSPORT

**INFORMATION CIRCULARS TO  
AIR ENGINEERS AND AIRCRAFT OWNERS**

1928-1939

Published by Authority of  
HON. C. D. HOWE, M.P., Minister of Transport  
V. I. SMART, Deputy Minister



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PRINTER TO THE KING'S MOST EXCELLENT MAJESTY  
1940





# DEPARTMENT OF TRANSPORT

## Air Services Branch CIVIL AVIATION DIVISION

### INFORMATION CIRCULARS TO AIR ENGINEERS AND AIRCRAFT OWNERS

1928-1939

The following Information Circulars to Air Engineers and Aircraft Owners issued during 1928-39 remain in force at this date and are reprinted herein:—

1930: O/40, T/2, T/3, T/4, T/5.

1931: T/3, T/4, T/17, T/22, T/25.

1932: T/1, T/2, T/5, T/6, T/7, T/8, T/9, T/13, T/15, T/17.

1933: O/29, T/8, T/9, T/10, T/11, T/13.

1934: O/42, T/1, T/3, T/7, T/9, T/10, T/11, T/12, T/14, T/15, T/17, T/18, T/19, T/21, T/22.

1935: T/1, T/2, T/4, T/5, T/10.

1936: T/2, T/3, T/4, T/6, T/7.

1937: O/42, T/1, T/4, T/5, T/6, T/8.

1938: O/36, O/46, T/2, T/3, T/5, T/6, T/8, T/9, T/10, T/13, T/14, T/16, T/19, T/20, T/21, T/23, T/25, T/28.

1939: T/1, T/2, T/3, T/5, T/7, T/8, T/9, T/10, T/11, T/12, T/13, T/14, T/15, T/16, T/17, T/18, T/19.

A number of Technical Information Circulars which have been issued during the past eleven years have been omitted from this book. Many of these are cancelled, others have become obsolete and the information which they contained has been brought up to date in subsequent issues. Others, however, which pertain to the modification of old types of aircraft are still in force but are now seldom referred to and it is not considered necessary to have them republished. Information Circulars pertaining to modifications of old types of aircraft may be obtained on application to Headquarters at Ottawa.

A list of enterprises in aircraft manufacture, repair and supply, with the names of approved inspectors, is revised from time to time and copies may also be obtained on application to Headquarters.

Dated at Ottawa, December 30, 1939.

## NOTICE

### Changes of Address

It is important that all Air Engineers and Aircraft Owners notify this Department promptly of any change of address in order that the delivery of Circulars and other matter may be assured.

### Aircraft Accidents

All aircraft accidents shall be reported to the Controller of Civil Aviation as required by Air Regulations 1938, Part VIII. If accidents involve death or injury to passengers, crew or third parties, they shall be reported by telegram. If damage does not extend beyond the aircraft, the accident may be reported by letter. In order that there should be no delay in carrying out the inspection of damaged aircraft or any investigation of the circumstances attending accidents, a copy of the telegram or letter should be sent direct to the District Inspector concerned.

Communications should be addressed to the Controller of Civil Aviation, Department of Transport, Hunter Building, Ottawa, Ontario.

### Air Regulations

Applications and inquiries relating to Air Pilots' and Air Engineers' certificates and examinations, registration and inspection of aircraft, and interpretation of air regulations should be directed to the District Inspector, Civil Aviation, for the district concerned.

### Air Regulations Districts

District Inspector, Air Regulations,  
400 Youville Square, Montreal, Que.  
Telephone—Belair 1125.

(Quebec, east of the 75th meridian of longitude, and the Maritime Provinces.)

District Inspector, Civil Aviation,  
No. 1, Montgomery Ave.,  
Postal Station "K," Toronto, Ont.  
Telephone—Mohawk 2988.

(That portion of Ontario lying south of the main line of the C.P.R. from Montreal to Sault Ste. Marie and west of the 77th meridian of longitude.)

District Inspector, Air Regulations,  
717 Dominion Public Bldg.,  
Winnipeg, Man. Telephone—95823.

(Manitoba and Northern Ontario west of the 86th meridian of longitude.)

District Inspector, Civil Aviation,  
Blowey Henry Building,  
Jasper Ave.,  
Edmonton, Alta. Telephone—22858.

(Saskatchewan, Alberta, and the Northwest Territories.)

District Inspector, Air Regulations,  
420 Federal Building,  
325 Granville St.,  
Vancouver, B. C. Telephone—Trinity 4616.

(British Columbia and Yukon Territory.)

## **Airways**

Inquiries concerning the inspection, licensing and registration of airports, the investigation, development and maintenance of airways and matters relating thereto should be directed to the office of the airways district concerned.

## **Airways Districts**

Headquarters District,  
Controller, Civil Aviation,  
Hunter Building, Ottawa.  
Telephone—2-8211, local 3357.

(That part of Ontario between 86° Long. and 74° Long. Except Pagwa Aerodrome.)

District Inspector, Western Airways,  
423 Post Office Building,  
Regina, Sask. Telephone—29121.

(Yukon, British Columbia, Alberta, Saskatchewan and that part of Northwest Territories lying west of 105° Long.)

District Inspector, Central Airways,  
802 Commercial Bldg.,  
Winnipeg, Man.

(Manitoba, that part of Northwest Territories lying east of 105°, and that part of Ontario lying west of 86° Long., and Pagwa Aerodrome.)

District Inspector, Eastern Airways,  
400 Youville Square,  
Montreal, P.Q. Telephone—Lancaster 5011.

(That part of Quebec lying east of 74° Long., and Maritime Provinces.)

Any parts of Canada not included in the above districts will come directly under the Controller of Civil Aviation at Ottawa.

## **Matters of Policy**

Matters of policy and any subject requiring a decision not already provided for in Air Regulations 1938, Information Circulars and other memoranda will be dealt with at Headquarters, Ottawa, and correspondence on such matter may be forwarded through the Branch Office or communicated direct to Ottawa.





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1930

O/40/30

21/10/30

### **INSPECTION OF AIRCRAFT FLYING CONTROLS— RESPONSIBILITY FOR**

The attention of all air engineers is again drawn to the fact that an air engineer who passes out an aircraft as airworthy for flight must accept the responsibility for the proper inspection of flying controls.

An accident recently occurred to a Club aircraft whereby the Pilot Instructor lost his life. The Court of Enquiry, which investigated the accident, established that the dual controls in the front cockpit had been removed for passenger carrying and had been replaced but not locked prior to the last flight. The rod which connects the front and rear rudder bars became disconnected in flight and the Pilot Instructor was unable to control the movements of the aircraft. The result was a fatal accident for which neither the Pilot Instructor nor his pupil were in any way to blame. The Air Engineer's certificate has been suspended for a period of six months.

T/2/30

21/2/30

### **D.H. MOTH—MODIFICATION TO RIB ATTACHMENT TO FRONT SPAR RIB ATTACHMENTS**

"The attachment of the main plane ribs to the front spar of D.H. Moth aircraft types 60X. G & M slotted wings is to be reinforced by means of a small pen steel clip. The rib attachment can be made accessible by locally cutting the fabric, then patching after the alteration has been made.

"This modification is illustrated by DeHavilland drawing No. M. 1226 (issue 4), copies of which, as well as the necessary parts, may be obtained free on application to the DeHavilland Aircraft of Canada, Ltd., Sterling Tower, 372 Bay St., Toronto."

The above modification is to be incorporated during the next overhaul and in no case later than six months from date of this notice.

T/3/30

1/3/30

### **D.H. MOTH 60X—MODIFICATION TOP FRONT SPAR OUTER JOINT OF MOTH AIRCRAFT**

The  $\frac{1}{4}$ -inch B.S.F. bolt at the top front spar outer joint on all D.H. Moth aircraft types 60X. G. & M. is to be replaced by a  $\frac{5}{16}$ -inch B.S.F. bolt in accordance with DeHavilland drawing No. M. 1193. Copies of this drawing and the necessary parts may be obtained from the DeHavilland Aircraft of Canada Ltd., Sterling Tower, 372 Bay St., Toronto.

Certificate of airworthiness for these aircraft will not be renewed unless this modification has been incorporated.

**T/4/30**

**15/3/30**

### **D.H. MOTH AIRCRAFT—STEEL FUSELAGE REPAIRS**

The steel fuselage of Moth aircraft are assembled with 36 light alloy blocks in the longerons at the points where bolts pass through to prevent the collapsing of the tube by the pressure exerted by the bolts.

The material, a magnesium alloy, forming these blocks is inflammable, and water will not quench the burning.

The heat of an acetylene torch will ignite these filler blocks before welding heat is attained. On ignition, the blocks melt, and where it is possible for the molten metal to run down the tube, adjacent fillers may become ignited.

Care must be exercised when repairing these fuselages by welding.

A modification calling for Steel Liners in the Top Rail was embodied on Moth Fuselage Serial No. 4692, and on all subsequent fuselages. The bottom Fuselage Rail is now being modified, and will commence on Serial No. 7239A and will be embodied on all subsequent fuselages.

**T/5/30**

**20/3/30**

### **TUBULAR STEEL FUSELAGES—WATER IN MEMBERS**

An accident to a Department of National Defence aircraft with a welded steel tubular fuselage raises a point of considerable interest to all operators of an aircraft of this type. The aircraft landed upon weak ice and went through into the water. It was salvaged in apparently good condition, and after the engine had been attended to the aircraft was flown to its destination. After arrival it was found that there were numerous splits and bulges in the tubular members of the fuselage, obviously resulting from water freezing in these tubes.

The attention of all personnel operating aircraft with this type of construction is drawn to the possibility of water finding its way into the tubes under circumstances such as this, and although on the ground the tubes may be in good condition and the water not frozen, temperatures may be met in the air sufficient to cause the water to freeze, with consequent damage to the tubing of the fuselage.

Constructors are strongly recommended to make all the components watertight, in order to avoid a recurrence of this trouble and also to reduce internal corrosion.

**1931**

**T/3/31**

**12/3/31**

### **GIPSY I AERO ENGINES—CHANGING OF CONNECTING ROD**

The DeHavilland Aircraft Company Limited state that it has been found by experience that the effective life of the original type connecting rod is 900 hours, and in their own interest owners of aircraft and engines are recommended to change these rods when that running time has been completed, as otherwise trouble may be experienced.

The original type of connecting rod has two holes on the under side of the small end, which converge into one hole where they enter the gudgeon pin bore.

The new type of connecting rod has two holes which are approximately 11 mm. apart where they enter the gudgeon pin bore.

**T/4/31**

**21/2/31**

**FAIRCHILD 71—FUEL SYSTEM**

Cases have occurred in flight in which the pilot has allowed one gravity tank to run dry and in switching over to another gravity tank has lost his engine. The conditions under which this might occur have been investigated and it is concluded that an air lock can be formed in the pipe between the gravity tank and the shut off cock. This air can be readily imprisoned in the pipe by filling one of the tanks which had previously been drained dry, the filling taking place with the shut off cock closed.

In order to prevent any possible failure of the engine under these circumstances, the following routine is recommended:—

- (i) When warming up the engine, each tank in turn should be used long enough to ensure that the gasoline is flowing freely from the tank to the carburettor.
- (ii) As a further precaution, it is recommended that a similar test be repeated during flight before any tanks are emptied.

**T/17/31**

**30/4/31**

**D.H. 60—(ALL SERIES)—RETAINING WASHER,  
PART No. H. 16132 FOR AILERON KING  
POST BALL JOINT**

Attention is drawn to the above mentioned washer, Part No. H. 16132, on D.H. 60 type machines. Owing to this washer having been reversed on one of the above aircraft, a failure at the shank of the rear end of the aileron gear connecting rod, Part No. H. 11801, has resulted.

Ground engineers should, therefore, make a special examination of this washer on all machines of the above type under their supervision. December 17, 1929.

**T/22/31**

**10/8/31**

**AIRCRAFT GASOLINE TANKS**

The necessity for extreme cleanliness of gasoline tanks is obvious and readily appreciated. The presence of foreign matter can generally be attributed to two reasons,—

- (a) insufficient care during manufacture of tanks and during assembly of the aircraft.
- (b) carelessness during fuelling and failure to filter the gas during this operation.

The condition quoted in sub-para (a) above is being constantly checked at Contractors' Plants, but carelessness during fuelling is a possible liability.

Pilots and Air Engineers are advised to supervise the fuelling of aircraft for which they are responsible to ensure that all reasonable precautions are taken for the exclusion of foreign matter.

During overhaul of aircraft, gasoline tanks which are not provided with hand holes of sufficient size and convenience to permit thorough cleaning and inspection, should be removed from the aircraft for this purpose.



Owners, pilots and responsible air engineers are advised to inspect thoroughly and, if necessary, to clean the gasoline systems of their aircraft when evidence of previous cleaning, within a reasonable period, is absent or indefinite.

Particular warning is issued regarding gasoline systems in which the lower portion of the main tank forms the reserve. With this arrangement the reserve collects all of the sediment and water resulting from repeated fillings and the effects of condensation during long periods of flying or idleness. When required, the reserve supply may be useless. An instance of this condition has occurred recently and resulted in considerable damage to the aircraft during the consequent forced landing.

The gas strainer which is installed in the pipe line to the carburettor is only intended to trap that foreign matter which other reasonable precautions have failed to exclude, and the reason for excessive collections by this accessory should be traced back to the tank. Otherwise it may be only a matter of time for a particular combination of conditions to occur and result in the choking of the strainer and stoppage of the fuel supply.

**T/25/31**

### **GIPSY MARK II AND III ENGINES**

**1/9/31**

It is hereby notified that:

(1) It has been noticed that, in the case of the above engines, there is a tendency for the thread of the bolts securing the rocker brackets to the cylinder head to stretch in service, which may lead to a mechanical breakdown. The constructors, the DeHavilland Aircraft Company Limited of Stag Lane Aerodrome, Edgware, have, therefore, introduced a stronger nut and a longer bolt.

(2) The bolts in question can be easily changed without removing the engine, and it is considered desirable that the new bolts and nuts should be fitted as soon as possible.

(3) Engines fitted with rocker covers having the hasp type fasteners require 12 bolts, Part No. 1302/36B and 12 nuts, Part No. 1302/65. Engines fitted with the later type rocker covers with central screw fastening, require 8 bolts, Part No. 1302/36B, 4 bolts, Part No. 1302/61A and 12 nuts, Part No. 1302/65. In either case 12 new split pins will be required.

(4) These bolts and nuts can be obtained on application to the DeHavilland Aircraft Company of Canada, Limited.

(5) The engine log book should be endorsed to show the incorporation of the modification.

**1932**

**T/1/32**

### **AIRCRAFT BOLTS**

**3/2/32**

For the information of all concerned, it is notified that the description "S.A.E." as applied to bolts does not necessarily mean that the bolts are fit for use in aircraft, though it does imply that the bolts conform to the sizes and threads laid down by the S.A.E.

Bolts of American manufacture for use in aircraft must conform to the maximum standard set in the U.S. Army & Navy Specifications AN-3 to AN-10, and such bolts may be identified by X stamped on the head.

**T/2/32****4/2/32****DUAL IGNITION AIRCRAFT ENGINES**

Engines with a power rating of 40 H.P. or more installed in aircraft of commercial registry or in private aircraft for which an Airworthiness Certificate is required must be fitted with dual ignition. Dual ignition is defined as the provision for each cylinder of two separate systems of ignition which shall be independent, except for the actual engine drive, so that the failure of one shall not directly affect the functioning of the second.

These requirements will be brought into effect in respect of all applications for certificate of airworthiness as follows:—

- (a) Applications for certificates of airworthiness for new types of aircraft—as from the date of issue of this notice.
- (b) Applications for certificates of airworthiness for aircraft of a type already passed as airworthy—after the 31st of December, 1932.
- (c) Applications for renewals of certificates of airworthiness—after the 31st of December, 1933.

It should be noted that although dual ignition is not compulsory on engines of less than 40 rated H.P., yet it is preferable.

**T/5/32****13/4/32****AERO ENGINES—SPARK PLUGS**

Spark Plugs are essential accessories, and the satisfactory operation of an aircraft engine depends, to a considerable degree, on the suitability of the spark plugs for the particular installation.

The type certificate of an engine is issued after its satisfactory performance in an observed test, during which certain types and makes of spark plugs form an essential part of the assembly.

The approved spark plugs are listed in the appropriate handbooks by the engine manufacturers.

The Department will consider an Aero engine airworthy only when fitted with serviceable spark plugs of makes and types approved by the manufacturer of the engine.

**T/6/32****11/5/32****D.H. 60 MOTH SPARS**

The attention of all concerned is directed to the fact that there are in existence two distinct types of wing spars for Moth aircraft, and that the maximum permissible all-up weight depends upon the type fitted.

Spars in accordance with D.H. Drawings H. 18720A, H.18721A, H.18722A, H.18723A are old type spars, and, where these are installed, the all-up weight of the aircraft must not exceed 1,400 lbs. for acrobatic and 1,650 lbs. for normal flying.

The introduction of D.H. Mod. No. 1055, dated 13-7-29, resulted in the construction being altered to conform with D.H. Drawings H.27949A, H.27950A, H.27951A, H.27952A, and the maximum permissible all-up weight of aircraft on which these spars are fitted is increased to 1,550 lbs. for acrobatic and 1,750 lbs. for normal flying. To enable ground engineers to identify the spars in the aircraft under their charge, the following Table has been prepared:—

Spar	Web Thickness		Flange Pkg. Pcs. (ash) Lengths		Flange Depth		Remarks
	Old	New	Old	New	Old	New	
Lower Front.....	$\frac{1}{4}$ "	$\frac{3}{8}$ "	10"	11"	.....	.....	
Lower Rear.....	$\frac{1}{4}$ "	$\frac{3}{8}$ "	10"	14"	$\frac{1}{4}$ 7/16	5/16 1/2 Centre-line	At edges On vertical centre line
Top Front.....	$\frac{1}{4}$ "	$\frac{3}{8}$ "	.....	.....	1/2 3/4  5/8	5/8 7/8 Centre-line 13/16 Centre-line	At edges top On vertical top  On vertical bottom
Top Rear.....	$\frac{1}{4}$ "	$\frac{3}{8}$ "	10"	14"	.....	.....	

No objection is offered against the use of old type spars on Moth 60 aircraft, provided the loading requirements specified in para. 2 above are strictly complied with, but attention is directed to the advisability of adopting the modified type when the opportunity arises.

Complete information regarding the two types of spars can be obtained on application to the DeHavilland Aircraft Company of Canada, Ltd., Toronto. It is advisable for all operators to consult the manufacturers when contemplating replacement of main spars to ensure that the construction will be strictly in accordance with the approved design.

**T/7/32**

### **D.H. PUSS MOTH INSPECTION FLAP**

**16/5/32**

Attention is drawn to the fact that the spring closed inspection flap on the upper side of the tail plane at the left of the fin may possibly foul the elevator if the return spring becomes weak or is left out of its proper position.

It is recommended that all owners rivet on to the rear downward projecting horn of this flap an extension piece of such a length that the elevator can never go low enough to pass it.

**T/8/32**

### **LIGHT ALLOY AIRSCREWS MAINTENANCE AND INSPECTION**

**1/6/32**

When aircraft are submitted for renewal of Certificates of Airworthiness, the owners will be required to show that the airscrews, if of light alloy material, have been proved airworthy by some form of adequate inspection and/or test.

For the information of owners and operators of such aircraft, there is reproduced herewith an Order and Instruction which has been issued by the Department of National Defence covering the maintenance and inspection of light alloy airscrews as used by the Department.



This circular is issued as an example of how such work is done in the Department of National Defence, and while it is not intended that any of the Orders as laid down in the circular for the Department of National Defence shall be obligatory for commercial firms, yet it is considered that the instruction reflects the best knowledge at present available on this subject and its adoption in whole or in part is recommended.

## MAINTENANCE AND INSPECTION LIGHT ALLOY AIRSCREWS

### Introduction

In the paras. and sub-paras. dealing only with light alloys, this Order and Instruction is applicable to all types of airscrew in which this material is used for the manufacture of the blades. The particular application of the remaining paras. is self-evident.

### Handling

These airscrews are easily thrown out of track if subjected to rough handling. During removal from packing cases and whenever it is necessary to lift them, the hold is to be applied to the thicker sections and not at the blade tips. Bumping of the tips on the floor or in any other manner is to be avoided.

### Installation

- (a) Check condition of airscrew shaft and bore of airscrew hub.
- (b) When shaft is splined, check angular back lash which is not to be more than 8 minutes. This is equivalent to .003 inches in the splines of a Wasp shaft.
- (c) Check tightness of main thrust nut.
- (d) Check condition of centering cones and corresponding seating in airscrew hub. Remove proud spots by local stoning, or with the tip of a small file. Match the fit of the cones by means of "marking." Cones are to be reground or replaced if their condition is not good.
- (e) Splined assemblies are to be put together dry except for a "wipe" of oil on the splines.
- (f) When shaft is tapered, check fit of hub and ensure that good contact, heavier on the larger diameter and lighter on the smaller diameter, is obtained. Proud spots caused by previous chafing are to be first removed by local stoning, and the desired fit may be obtained by lapping. Discretion must be exercised when lapping to avoid spoiling a good shaft by fitting an incorrect or otherwise unserviceable hub to it. Check fit of key with particular regard to clearness on the top.
- (g) Tapered assemblies are to be put together with a wipe of thin oil or with a little finely ground graphite. In the first instance the surfaces should not be more than just oily to the touch, and in the second instance more graphite than would be left by the application of a black lead pencil is unnecessary and undesirable. The use of flake graphite is forbidden.
- (h) The airscrew retaining nut is to be well oiled and tightened up firmly. The length of leverage necessary will vary with the size of the airscrew. A short handled wrench and heavy hammering damages the thrust bearing and does not provide the mechanic with a true estimate of tightness. Swinging on an excessively long wrench is also unsatisfactory and can result in

enormous stresses in the airscrew shaft. A three-foot wrench on a Wasp should provide sufficient leverage with the help of light hammer blows to give vibratory assistance. Care is to be exercised when tightening the locking nut on Gipsy-Hamilton Standard Airscrews. In this assembly the halves of the hub can be readily separated by overtightening the locking nut, and this is to be avoided.

## Inspection

An inspection of blades and hub is to be made daily before flight for the detection of damage and the initial stages of cracks, and appropriate entries made in the airscrew log book. Defective airscrews are to be dealt with as follows:—

- (a) Adjustable airscrews, if cracked in hub or blade, are to be made "Unserviceable" immediately. Examine the back of the hub and the shank of the blade on the trailing side, as this is where known instances of failure have commenced.
- (b) Nicked blades are to be carefully examined in the vicinity of the damage. When the damage is slight ( $\frac{3}{32}$ -inch on the edge or  $\frac{1}{16}$ -inch on face or back), and the appearance of the material in the vicinity is satisfactory, the airscrew may continue in service. The surrounding material should be eased away by file and polished, without further undercutting, to remove the abrupt change of section caused by the damage. Do not repolish at subsequent inspections as this will obliterate the surface condition which the process is intended to manifest. Immediate steps are to be taken to obtain replacements for airscrews with badly nicked blades, and at the first signs of cracks in the hub or in the blades.
- (c) Fairey Reid airscrews are to be inspected as follows:—
  - i. After every ten hours' flying those fitted with metal hub blocks are to be removed from the hubs and spinners, where fitted, are to be removed from the airscrews,—the hub blocks are not to be removed from blades for this inspection.
  - ii. The blade sheet on both sides and on both edges is to be examined for signs of fracture in the region of the identification stamping and also immediately outside the hub blocks, particularly on the leading and trailing edge portions of the sheet projecting transversely from these blocks. Both surfaces of the blade sheet are to be examined for signs of fracture where the surfaces are visible through the apertures provided in the metal hub blocks for lightening purposes.
  - iii. On those fitted with wooden hub blocks the particular inspection may be confined to the material in the region of the identification stamping. This inspection can be made without removing the airscrew from the aircraft.
  - iv. There is a tendency for the wooden hub blocks to crack from shrinkage due to overdry storage conditions. A few small checks are not detrimental provided there is no indication of breakdown of the glued joints between laminations. The development of a serious condition is to be avoided by maintaining correct humidity conditions in storage and in hangars, by keeping the hub blocks well varnished and by coating them with paraffin wax during periods of storage and while in transit.



## Maintenance (Service)

- (a) On newly fitted airscrews the tightness of the airscrews securing nut is to be checked immediately after the first flight while the engine is still hot, and subsequently at 10 hours' and 20 hours' flying.
- (b) On Fairey Reid airscrews the tightness of the hub bolts is to be similarly checked, and at 50 hour periods thereafter.
- (c) Rough running of engines, except where other causes can be definitely identified, are to be investigated by inspection of blades for change of setting, and removal of the airscrew for checking engine thrust nut, splines and cones. If rough running persists with a new or repaired airscrew, and the trouble cannot be identified with any of the causes mentioned and provided the static balance of the airscrew is found to be correct, it is to be returned suitably tagged to No. 1 Depot. There may be a condition of dynamic out of balance of the airscrew.
- (d) The roughness of tips and leading edges of blades, caused by water erosion or sand, is to be removed as far as possible by the use of emery cloth or fine file. The approximate aerofoil section should be maintained to obviate loss of efficiency.
- (e) On airscrews operated over salt water (at the coast) the smoothing of the leading edges is to be carried out at frequent intervals and the blades wiped and re-oiled every day after flight. The result of salt water corrosion is intercrystalline and cracks attributable to this cause have been noted.
- (f) When removing a tight Hamilton Standard Airscrew from the engine shaft, there is danger of straining the hub, as the load is transmitted from the front half of the rear half through the blade clamps, and some set-screws in the larger types. The hub can be considerably stiffened by moving the clamps nearer to the centre of the hub. If the airscrew is serviceable, great care must be taken to avoid alteration to blade angles, the clamps being re-adjusted in the exact position from which they were moved. A special clamping device for attachment near to the centre of rotation of the hub is being designed for use in extracting tight H.S. airscrews from "Gipsy" engines. (Drawing No. R.C.A.F. 2094).

## Etching

- (a) Airscrews installed on training aircraft and other aircraft subjected to acrobatics are to be removed at 200 hour periods for dismantling, etching of blades and careful examination of blades and hub for cracks or signs of fatigue.
- (b) Other airscrews are to be etched and examined annually, except that when the annual hours will be more than 300, the operation is to be carried out at this period. When the annual hours are less than 100, the operation may be deferred until 300 hours but is not to exceed two years. Change of engine should normally be accompanied by replacement of airscrew.
- (c) An airscrew installed on an engine which has developed a serious condition of roughness, and by accident or necessity operated in this condition for a period of hours, is to be removed from the engine, dismantled and inspected at the earliest opportunity.

## Setting of Blade Angles

- (a) Table "A" of this Order gives the approved setting of all adjustable airscrews in service. These settings are not to be changed without H.Q. authority, and criticisms are to be submitted through the usual channels. Except in emergency, blade settings are not to be adjusted or blades replaced in the field except by qualified personnel, owing to the difficulty in providing the accuracy of the blade angle and balance necessary for satisfactory operation.
- (b) The angles of blades on any adjustable airscrew are to be equal within a limit of six minutes at corresponding stations.
- (c) The permissible limits of blade angles on new Fairey Reid airscrews are plus or minus  $1^\circ$  at stations on the inner third and plus or minus  $\frac{1}{2}^\circ$  at stations on the outer two thirds, and the difference in angles at similar stations on opposite blades is not to exceed  $1^\circ$  and  $\frac{1}{2}^\circ$  respectively.
- (d) Care is to be taken to ensure that the thrust collars of adjustable blades are in contact with the corresponding faces in the hub.

## Track

The permissible limits of track of the blade tips measured from a datum plane containing the axes of the blade shanks, on adjustable airscrews; or the centre of the blade sheet measured at the hub on Fairey Reid airscrews, are:—

Dia (Up to)	7 ft.	9 ft.	11 ft.
New.....	$\frac{1}{32}$	$\frac{3}{64}$	$\frac{1}{16}$
Service.....	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{8}$

NOTE:—The difference between track of respective blades may be twice the amount shown in this table.

## Balancing

The permissible error in static balance of the complete airscrew is 1 inch ounce and balancing equipment is to be maintained in a condition to provide this degree of accuracy. During the balancing of airscrews which are keyed to taper airscrew shafts in service, a half key is to be used in the key way in the hub to reproduce the correct assembly condition.

## Marking

- (a) Dates of re-etching are to be stamped on the butt of the blade, if necessary, the end chamber may be utilized for this purpose. The blades are not to be stamped in any other location.
- (b) A paint mark is to be placed in the angle between blade and hub, after setting, to provide a "witness" against accidental or other change in setting.
- (c) Blade drawing numbers, dates of last re-etching and repair, setting, and aircraft and engine types, are to be written on the blades after assembly and the inscription protected with a coat of varnish. It is not expected that this inscription will remain on permanently, but it will provide a direct means of information for Stores purposes and log book notation.



## Finishing

The flat sides of blades are to be finished with one coat of red oxide primer to prevent "glare." The tips on the reverse side are to be painted with the same material for a distance of 6 inches. Heavy coats of paint are to be avoided as they have a tendency to creep, and to throw the air-screw out of balance.

## Repairs-Hamilton Standard Adjustable Metal Airscrews

- (a) Repairs to this type can be classed under four headings:—
  - (i) Replacement of components.
  - (ii) Removal of tips and leading edge damage.
  - (iii) Correction of slight bends in blades.
  - (iv) Correction of more severe bonds.
- (b) Hubs are machined in pairs and are to be replaced by pairs, when either the front or the rear portion of the original hub is unserviceable. Unserviceable blades may be replaced by new blades or preferably by other serviceable blades with similar flying hours of service. In each instance the two blades are to be matched in length, profile and balance.
- (c) It has not been possible to set definite limits for permissible reduction in diameter but 2 per cent of this dimension may be taken as a general limit. It has been found that reduction by this amount does not affect the performance of the airscrew to a material extent. When slight change of pitch is necessary, it is useful to know that a difference of  $1\frac{1}{4}$  r.m.p. (approx.) results from a change of one minute in pitch angle.
- (d) Bent blades are repairable when the bend is not nearer the shank than the mid-section and when the curvature is such that the surface of the blade on the outside of the bend shows no signs of strain. These repairs are outside the scope of R.C.A.F. stations as a special screw press is required, the ordinary arbor press being unsuitable by not providing sufficient control to prevent over-correction. The operator also needs experience and constant practice, as well as facilities for heat treating blades except in instances of very minor bends.
- (e) Airscrews having bent blades are to be shipped to No. 1 Depot for repair action, or to an approved Contractor as may be directed by Headquarters.

## Fairey Reid Airscrews (Repairs)

- (a) Fairey Reid airscrews requiring repair, other than the trimming of tips and leading edges, are to be shipped to No. 1 Depot or to an approved Contractor if so directed by Headquarters.
- (b) Special tools are required for setting pitch angles on this type.

## Spinners

Spinners are to be balanced with the airscrews to which they will be assembled in service.

## Records

A record of receipts, transfers, installations, etchings, inspections, blade angle settings, changes of blades or hub, repairs and hours run, is to be kept in the appropriate airscrew log book. In general the first number and letter of the Hamilton Standard blade symbol refer to the basic blade design. The third number refers to the size of the shank and minus

nought means that the blade forging has been used at its maximum diameter. Minus any number means that the blade forging has been reduced by that number of inches and the addition of a letter after the number refers to some change in the pitch angles to accommodate a change of V/ND ratio.

### Storage

Airscrews are to be stored in their packing cases or supported on pegs through the centre of the hubs.

### Replacements

Commanding Officers of Stations or Detachments are to anticipate requirements of spare airscrews for the replacement of those which will have to be shipped for periodic re-etching and inspection.

### Etching

For use on light alloy airscrew blades during inspection to increase the visibility of fatigue cracks, corrosion cracks and other minute defects which may be present on shank or blade.

- (a) For complete immersion, suitable tanks constructed of wood, glass or earthenware are required, although a steel tank will be found satisfactory for the etching bath.
- (b) *The etching agent* is to be made by dissolving 1 to 2 pounds of commercial caustic soda in each gallon of water to form a 10 per cent to 20 per cent aqueous solution.
- (c) *The neutralizing agent* is to be made by adding 1 gallon of commercial nitric acid to each 5 gallons of water (the acid should always be poured slowly into the water).
- (d) The blade requiring inspection is to be first cleaned with acetone or by a 15 to 30 minute immersion in boiling cleaner of suitable concentration for use on aluminum alloy parts. Paint and dirt is to be eased off with a fibre brush or rag swab. Wire brushing or scraping is not to be used as these methods not only damage the surface but obliterate the evidence which the process is intended to reveal. Etching may be effected by complete immersion of the blade or by swabbing with the caustic solution, care being taken to avoid damaging the hands. The etching bath is more effective if heated. Electric immersion heaters have been found to be troublesome and where the container is made of steel, a flame underneath is satisfactory. A sufficient depth of etch can be obtained by two to six minutes immersion and longer periods in the etching solution are to be avoided. After etching, the blade is to be rinsed immediately with water and swabbed with the nitric acid solution until it is white and all traces of the black deposit have been removed:—wash and dry. These operations may be repeated until the desired depth of etch is obtained.
- (e) The blade is then to be inspected all over with a magnifying glass. Particular care is to be taken when inspecting the shank and the vicinity of recent or earlier damage to leading edge or surface.
- (f) It is very desirable that the blades be polished after etching. This removes the layer of material which has been attacked by the etching agent and the "cold work" of polishing adds to the strength of the material. The polishing operation should follow the length of the blade so that any cracks which may develop will be most easily detected.



- (g) Cracks, if present, will usually be found to run at right angles to the axis of the blade. Blades in this condition are to be rejected immediately and the defect plainly marked pending disposal action. Longitudinal marks may be due to laps during forging and defects of this description are usually not dangerous.
- (h) It is necessary to remove the hub blocks from Fairey Reid airscrews for the inspection of this type by etching so that observations can be made in the vicinity of the bolt holes and where the extra stiffening, due to the hub, constitutes an abrupt change of section of the blade.
- (i) Blades showing unusual surface conditions, which may indicate the presence of fatigue, are to be placed "unserviceable" and are to be forwarded to No. 1 Depot for further examination by C.A.E. unless the unusual condition can be definitely attributed to other causes. It should be remembered and appreciated that the failure of a metal airscrew is a very serious matter as the large out of balance forces will tear the engine from its mounting before the pilot can switch off.

T/9/32

5/7/32

### D.H. 60 MOTH AIRCRAFT AT 1,750 LBS.

Information Circular No. T/6/32 of the 11th of May, 1932, described in detail how an air engineer might check the spars in the DeHavilland "Moth" aircraft to identify them with the DeHavilland modified spars as used on aircraft for which a total all up weight of 1,750 pounds was claimed for normal flying.

The British Air Ministry has pointed out to this Department that the increase in weight was conditional not only upon this modification to the spars but also upon modifications to the lift wires, the interplane struts and the elevator spar.

It is presumed that all D.H. Moth aircraft built since the introduction of D.H. Modification No. 1055, dated 13/7/29, are eligible for an all up weight of 1,750 pounds for normal flying, but engineers should, however, identify the details of construction of the aircraft for which they are responsible to see that the spars, lift wires, interplane struts and elevator spars conform to the details given in Information Circular No. T/6/32 and on the following schedule.

### MOTH 60 M. (1,750 POUNDS)

Part Nos. and Size of Lift Wires, Interplane Struts and Elevator Spar.

#### 1. LIFT WIRES

##### (a) *Front Lift Wire—*

Part No. H18861 Issue 6 Specification 4 W 3 Size  $\frac{5}{16}$  inch B.S.F.

##### (b) *Rear Lift Wire—*

Part No. H 18862 Issue 6 Specification 4 W 3 Size  $\frac{1}{4}$  inch B.S.F.

#### 2. INTERPLANE STRUTS

##### (a) *Front Interplane Strut—*

Part No. H 29492 Issue 6 Specification 2 V one Spruce "A"  
Size  $1\frac{1}{8}$  inch by  $4\frac{3}{8}$  inch.

*(b) Rear Interplane Strut—*

Part No. H 29493 Issue 1 Specification 2 V one Spruce "A"  
Size  $1\frac{5}{8}$  inch by  $4\frac{3}{8}$  inch.

**3. ELEVATOR SPAR**

Part No. H 27953 A Issue 1 Spec. 2 V One Spruce "B" Size  
 $1\frac{5}{8}$  inch by  $1\frac{1}{4}$  inch tapering to  $1\frac{1}{8}$  inch Packing Block—  
Part No. H 27580 Issue 2 on side of spar  $18\frac{5}{16}$  inch long.

**T/13/32**

**12/9/32**

**SEPARATE LOCKING OF TURN BUCKLES**

Instances have occurred in which the turn buckles of twin adjacent control cables have been locked by a single length of locking wire. This practice is dangerous as vibration and relative movement of the cables may lead to failure of the locking wire.

All turn buckles should be locked individually and any adjacent turn buckles found locked by one length of locking wire should be unlocked and properly secured.

**T/15/32**

**14/10/32**

**D.H. 60M AND T "MOTH"**

**D.H. 82 AND 82A "TIGER MOTH"**

**INSPECTION AND MODIFICATION OF REAR  
FUSELAGE**

It has been found that defects are likely to occur in the rear end of the fuselage of aircraft of the above types. These defects appear as cracks in the longerons at or near the ends of the transverse gusset plates between the left and right hand longerons, just in front of the sternpost, and are due to racking loads from the tail skid.

Accordingly, the bottom longerons in the skid bay are to be immediately inspected for signs of cracks. If any such defects are found, the aircraft must be modified.

The following repair has been approved:—

Both adjacent longerons are to be cut out of the bay and new lengths of longerons welded in and a modified gusset plate H. 37982 is to be welded in place as shown on drawing No. M. 1911, issue 2, part A, issued by D.H. Aircraft Company.

If no cracks are detected, further inspections are to be made at frequent intervals.

The modification does not apply to certain early D.H. 60M aircraft in which the fuselage is partly wire braced.

**T/17/32**

**10/12/32**

**D.H. PUSS MOTH 80A**

**RUDDER—BALANCE WEIGHT**

A balance weight is to be added forthwith to the rudder of Puss Moth aircraft as shown on DeHavilland drawings No. D.H.C. 1080 and 1081. The balance weight and the above mentioned drawings can be obtained directly from the DeHavilland Aircraft of Canada, Ltd., Toronto.

The top speed of Puss Moths is to be limited to 105 M.P.H. until this balance weight has been fitted.

The above modification is applicable to both small and large size rudders, to drawings U. 2252 and U. 2294, respectively.



1933

O/29/33

22/6/33

**CERTIFICATES OF AIRWORTHINESS  
AIR ENGINEERS' RESPONSIBILITY  
AND AUTHORITY**

Owing to the limited staff available, it is not possible for the Department to exercise close supervision over aircraft construction and repair. It is, therefore, only possible for the Department to endorse Certificates of Airworthiness when the owner of the aircraft produces satisfactory proof that construction and reconditioning have been carried out in an airworthy manner. The only acceptable means for an owner to prove that this has been done is to have the work certified by a licensed air engineer who is qualified and authorized by the terms of his licence to certify to the airworthiness of the aircraft in question.

T/3/33

14/6/33

**GIPSY AERO ENGINES—A.M. No. 29—1933**

It has been found by experience that certain Y alloy connecting rods with embossed lettering and Part Number on the shank, fitted to early Gipsy I, II and III engines, have small surface cracks, the origin of which has been traced to the stamping process. These cracks, if discovered in the early stages, can be satisfactorily removed by the method subsequently described, but if allowed to remain, they are liable to develop and ultimately result in failure of the rods.

This form of defect has been eliminated in rods of recent manufacture by changing the material from Y alloy to D.T.D. 130, omitting the embossed lettering, improving the stamping process, machining and/or polishing the whole surface. Consequently, those rods which have no embossed lettering on the shank and stamped D.T.D. 130 may be regarded as satisfactory and not subject to the conditions of this Notice.

During the next top overhaul of engines, any connecting rods of the type referred to in the first paragraph are to be removed and treated as follows:—

- (i) The embossed letters and figures should be carefully removed with a file.
- (ii) If a buffing machine is available, all traces of file marks should be removed on the buff and a high polish obtained. During this operation, careful attention should be paid to the elimination of the small cracks which, if present, will be found round the letters, but the minimum amount of metal is to be removed.

Having satisfied the above requirements, special attention is to be paid to the opposite side of the rod, where, in all probability, it will be found that, owing to the reversing operation of the rod during stamping, the cracks may penetrate slightly deeper than they did on the side with the embossed lettering. During the buffing operation on this side, careful inspection should be maintained to determine the progress which is being made. The buffing operation should be stopped.

- (a) as soon as the cracks have been removed, or
- (b) as soon as the minimum thickness of the web has been reached.

In the case of Gipsy I connecting rods, the minimum thickness allowed is 4.5 mm. (.018 inch), and for Gipsy II and III rods 6.5 mm. (.026 inch). Any connecting rods which still show the slightest sign of a crack when these dimensions have been reached should be rejected.

Where a buffing machine is not available, the lettering and figures should be removed and all file marks removed with a flat or half round scraper, care being taken to keep the surface of the rod flat. The rods should then be polished with smooth emery cloth until the surface is perfectly clean and free from scratches or scraper marks. The emery cloth used should not be coarser than 00 grade.

When dealing with the opposite side of the rod, the same observations as detailed above are required, but in lieu of buffing, cracks should be removed by careful filing, scraping and polishing.

Having completed the above operations, attention should be paid to other parts of the rod in which defects have been found to occur as follows:—

- (a) Along the edges of the "H" section, particularly where the section joins the gudgeon pin and big end bosses.
- (b) Around the oil holes running from the bottom of the "H" section into the gudgeon pin bore.
- (c) Where the top face of the bolt boss joins the rod section (i.e., adjacent to the face engaging the connecting rod bolt nut).

The rod should be carefully polished at all these points under the procedure already outlined, particular attention being given to the removal of machine marks or longitudinal scratches when dealing with (c).

When all the above conditions have been met, the rod is in a fit state for etching. This should be carried out by the following procedure:—

#### *Hydrofluoric Etching*

Two baths are required for this process:—

- (i) a bath consisting of hydrofluoric and sulphuric acid in the following proportions:—

Hydrofluoric Acid.. . . . .	1 part.
Ten per cent Sulphuric Acid.. . . . .	5 parts.

It is essential that this solution be kept in a lead bath and used cold.

- (ii) a bath of 50 per cent nitric acid in water (cold).

In preparing this bath, add nitric acid to water—not vice versa.

The rod should be completely immersed in Bath (i) for a period of one minute (it is imperative that this time is not exceeded) and then transferred quickly to Bath (ii) and wiped over whilst in the bath with a small mop or wad of cotton wool, held in a pair of tweezers, until clean, after which it is to be thoroughly washed in running water to remove all traces of acid. This is to be followed by immersion in boiling water for five minutes. When the rod is dry, a thorough examination of all surfaces of the rod should be made through a suitable magnifying lens. A small mirror should be used to assist inspection of the small end bore. Any rods found to be cracked must be rejected.

Rods which have had the lettering removed and which are found to be free from cracks are to have the Part Number lightly stamped or engraved along the outside of one of the big end bold bosses. In carrying out this operation, great care must be taken as heavy stamping of the rod may possibly lead to fatigue cracking or distortion of the bolt hole. A suitable record should be made in the Engine Log Book when the work detailed in preceding paragraphs has been satisfactorily carried out.

Rods that have been treated in accordance with this Information Circular are, in addition, to be polished, etched and examined in the manner described herein at each complete overhaul, notwithstanding the fact that they were rectified at the top overhaul preceding the complete overhaul.



It is pointed out that Gipsy I connecting rod is not interchangeable with the Gipsy II and III rods from a strength point of view, although the dimensions are such that it is possible to fit a Gipsy I rod into the Gipsy II and III engines. The Part Number of the Gipsy I rod is 800-10 and of the Gipsy II and III rods, 1300-15.

A number of Gipsy I connecting rods, Part Number 800-10, have the two oil holes in the underside of the gudgeon pin boss drilled close together so that they merge into one hole where they enter the gudgeon pin bore. Rods so drilled are very prone to cracking and their maximum safe life has consequently been fixed at 600 hours. Rods which have completed 600 hours' running are to be removed from engines and replaced by others of later manufacture, as listed below, and where no evidence of the number of hours' running can be produced, they are to be renewed within two years of the time the engine was first put into service.

- (i) Rods in which the holes are approximately 11 mm. apart where they enter the gudgeon pin bore.
- (ii) Rods having the holes omitted entirely.

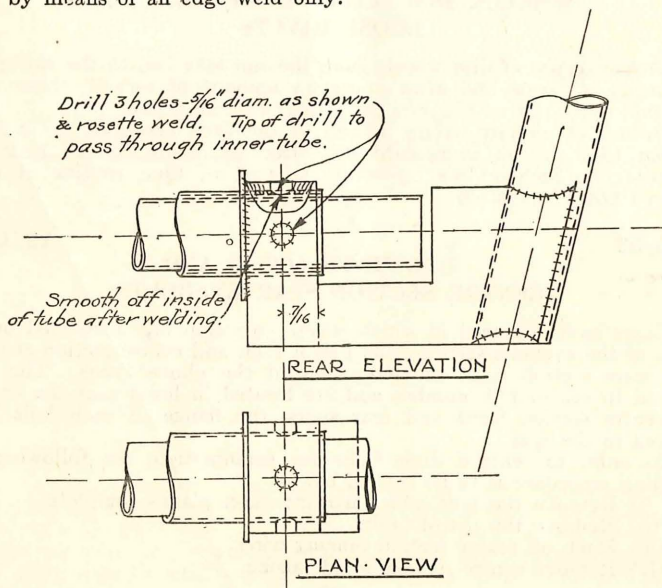
Certificates of Airworthiness of any aircraft fitted with engines of the types referred to in this Notice shall be liable to suspension or cancellation if the requirements herein have not been complied with and Air Engineers must not sign daily certificates in respect of such aircraft unless the instructions have been satisfactorily carried out.

T/9/33

### BELLANCA PACEMAKER—RUDDER PEDALS

20/6/33

The cranked fitting at the bottom of the right hand pilot's right rudder pedal lever secures the tube connecting to the other pilot's corresponding lever by means of an edge weld only.



Owners are advised to inspect this connection carefully and if there are any signs of failure, the joint should be repaired and reinforced by the addition of three rosette welds as illustrated below.

This reinforcement is to be embodied in any case before the next renewal of Certificate of Airworthiness.

**T/10/33**

**29/9/33**

**GIPSY MARK I AND MARK II AND GIPSY  
MAJOR ENGINES—WOODEN AIRSCREWS**

Instances have occurred of splitting of above airscrews in the region of the boss due to the transmission of part of the airscrew torque by the hub bolts instead of entirely by friction at the rear boss face.

Wooden airscrews which are or have been in use on these engines are immediately to be removed from the hubs and examined for signs of fracture of the boss, particularly at the rear face in the region of the bolt holes.

Any such airscrews showing signs of fracture are to be regarded as unserviceable.

When assembling serviceable airscrews and hubs, care must be taken to ensure that the hub bolt nuts are adequately tightened before being locked. In order to maintain the friction drive, the tightness of these nuts is to be checked periodically and any slackness found is to be taken up. With airscrews in frequent use, this periodical check should be made at the end of every 25 hours' flying, while, in the case of new airscrews, the tightness of the nuts should be verified during the first 10 hours' flying.

**T/11/33**

**28/9/33**

**WHEELS, DISC TYPE—INSPECTION FOR  
LOOSE RIVETS**

Certain types of disc wheels have the rim attached to the side plates by means of rivets and after a certain amount of service, these rivets may fail, especially on the side carrying the brake drum.

Owners of aircraft having wheels of the type described are strongly advised to make an immediate inspection by removing the tires and, thereafter, to include this inspection as part of their routine at every hundred hours' operation.

**T/13/33**

**12/12/33**

**D.H. MOTH 60X, G AND M  
CENTRE SECTION SPAR EYEBOLTS**

Cases have occurred in which severe corrosion has developed on the stems of the eyebolts securing the petrol tank and centre section struts to the centre section spars on aeroplanes of the above types. The bolts referred to are four in number and are located in holes near the ends of the centre section front and rear spars, the flange of each bolt being sweated to the spar.

In order to remove these bolts for examination, the following dismantling procedure is to be carried out:—

- (i) Remove the port and starboard main planes complete.
- (ii) Remove the petrol tank.
- (iii) Slack off centre section bracing wires.
- (iv) Remove centre section wood fairing.

The flange of each bolt is then to be unsweated, care being taken to confine the applied heat to the bolt flange. The top end of the bolt should be tapped to assist loosening. Any corroded bolts must be replaced by new ones. On reassembly, it is not essential to resweat the bolts in position as the sweating provides for location only.

If, during this inspection, there arises any suspicion that the centre section spar has been attacked by corrosion, the end fittings should be removed by driving out the rivets and unsweating and the interior of the tube should be thoroughly inspected. If corrosion has begun, the tube should be replaced.

1934

O/42/34

19/10/34

#### AMENDMENTS AND ENDORSEMENTS TO LICENSES

District Inspectors are authorized to amend and endorse Pilot's and Air Engineer's certificates and Certificates of Registration and Airworthiness under certain conditions.

Any amendment or endorsement to a certificate or licence made by an unauthorized person will result in the immediate suspension of any certificate or licence involved.

All aircraft owners are warned, therefore, that no amendments or endorsements are permitted to be made to any certificates or licences issued by the Department of Transport except by its authorized representatives.

T/1/34

4/1/34

#### BELLANCA PACEMAKER RUDDER CONTROL CABLES

An instance has been brought to light of a severe wear in the rudder control cables where they pass under the cabin floor in the above aircraft. Unless some provision has been made for removing that portion of the cabin floor for inspection purposes, the entire control cable cannot be viewed without opening the fabric covering on the fuselage.

It is, therefore, brought to the attention of all concerned that periodical examination of the full length of the rudder control cables must be made and that suitable means must be provided so that this examination may be conveniently carried out in future.

T/3/34

12/1/34

#### FIRE HAZARD—REFUELLING

Attention is drawn to the possibility of fire occurring as the result of the generation of frictional electricity during the refuelling of an aircraft; serious fires have arisen from this cause. Gasolene is a poor conductor and frictional contact with another insulator will induce in the gasolene a static charge of electricity; a rubber filler pipe or a chamois leather filter is particularly effective in this respect. Differences in electrical potential may arise between filling nozzle, funnel and tank of an amount dependent on the quantity of the gasolene delivered, the speed of delivery, and the dryness of the atmosphere at the time, and under favourable conditions a spark of sufficient intensity to ignite inflammable vapour may be produced.

Differences in potential can be prevented by earthing and providing metallic connection between all metal parts with which the gasolene comes into contact during the operation of filling.



**T/7/34**

**23/2/34**

### **GIPSY MAJOR ENGINES—AIRSCREW HUBS**

An improved design of airscrew hub to G.A. drawing No. 1900 has been introduced for use on Gipsy Major engines and hubs of this design will be fitted to new Gipsy Major engines, commencing with engine number 5434.

The new design differs mainly from the earlier design, which is the standard for Gipsy I, II and III engines, in that the rear flange is appreciably greater in diameter. Other changes have also been incorporated, including a small increase in the diameter of the front flange.

It is found that, in general, a ridge is formed on the boss faces of wooden airscrews, irrespective of the engine on which they have been used, as a result of the timber being indented by the hub flanges. Wooden airscrews, therefore, which have been used on Gipsy Major hubs of earlier design and which are required to be fitted to hubs of improved design, are to be examined for signs of indentation of the boss faces. If such indentations are found, the boss faces are to be trued up, preferably by an airscrew manufacturer. The finished surfaces should be flat and smooth and a witness of the original hub flange marking must be left on each face to ensure that it is perpendicular to the axis of the bore. Care should be taken that only the minimum amount of timber is removed. Finally, the trued-up surfaces are to be revarnished. (A.M. Notice to Ground Engineers No. 4, 1934).

**T/9/34**

**23/3/34**

### **GIPSY III—INTAKE MANIFOLD—PART No. 1054-1**

Corrosion of the intake manifold surfaces forming the internal walls of the exhaust heated jacket has been reported quite frequently. This corrosion, once started, progresses when the engine is idle as well as in service.

Operators are, therefore, warned of this deterioration and are advised to inspect the manifolds periodically. A loss of r.p.m not otherwise accounted for may be attributed to the leakage of exhaust gases into the induction system at the points where corrosion has occurred.

Operators are advised not to attempt repairs but to obtain the latest type manifolds from the manufacturers (Gipsy Mod. No. 394).

**T/10/34**

**4/5/34**

### **WING LOCKING PINS**

Another accident has occurred to a folding wing type biplane due to the wing locking pin in the front spar of the top plane not being inserted in its correct position through the lugs in the centre section and main spar.

The attention of all operators was drawn to a previous accident and they were warned to take particular care to see that all locking pins in folding wing type aircraft were in correct position before the aircraft takes the air. If the top pins are inserted first, their engagement can be adequately tested before the lower pins are inserted and tested.

An inspection before flight by the air engineer must include an inspection of the folding fittings, as well as the fact that the wings are properly locked in place. Aircraft may only be folded under the direct

supervision of licensed personnel, either pilots or air engineers, and similarly their wings may be spread only under the supervision of such licensed personnel.

The airworthiness of the aircraft for flight is a definite responsibility of a licensed air engineer, which responsibility must be shared by the pilot.

**T/11/34**

**31/5/34**

### **PRECAUTIONS AGAINST FIRE DURING WIRELESS TRANSMISSION**

There is a risk of fire occurring on aircraft fitted for wireless transmission because of the possibility of a breakdown of insulation between the drum of the aerial winch and the aerial winch frame when a trailing aerial is in use.

Air Engineers must ensure that the aerial winch frame is electrically bonded to the main earth system of the aeroplane in a satisfactory manner.

**T/12/34**

**31/5/34**

### **INTERNAL CORROSION IN STEEL FUSELAGE MEMBERS**

The attention of all concerned is directed to the possibility of serious corrosion which may occur within steel tube structures and which may not be apparent externally until penetration of the tube walls has occurred and the structural strength has been very seriously reduced. This corrosion is particularly active when aircraft are used as seaplanes operating from salt water. Lower longerons and cross struts are particularly vulnerable, especially when the fuselage members as a whole are inadequately protected internally and are not sealed against the effects of salt laden air.

An incident has recently come to the attention of the Department in which an aircraft with approximately 1,200 hours' flying time had been passed as airworthy by two competent inspectors and three months later, while being reconditioned, was found to be unserviceable because of excessive internal corrosion of the lower longeron. The significant point is that this dangerous condition was not detected by competent inspectors during a normal external inspection and, whereas this condition perhaps to a lesser degree, was present at that time, it was not finally detected until the walls of the tube fell away with the removal of paint during overhaul three months later.

Because it is impracticable to determine definitely whether or not the internal surfaces of steel tube structures are adequately protected against corrosion, it must be assumed that under adverse conditions internal corrosion will occur and adequate precautions must be taken to guard against it.

While a definite technique has not been developed, the use of a self-acting, spring loaded centre punch, equipped with a small ball point, and applied on suspected members is considered to be capable of useful development. The application of such a punch will not injure a tube which is not badly corroded but will indicate a faulty member by an easily perceived indentation. To ensure that this procedure is effective,



it has been found necessary to apply the punch at points not greater than one-quarter of an inch apart over the area suspected. After prolonged exposure to adverse conditions and at periods not exceeding three years, it is considered advisable to remove sections of suspected tubing and in particular the rear sections of the lower longerons for internal inspection.

Aircraft with welded steel tube fuselages which have operated at any time as a seaplane on salt water and which are three years old must be considered as particularly liable to this form of corrosion.

Such aircraft are to have a portion of the lower fuselage longeron removed for internal examination during the next overhaul and in any case before renewal of Certificate of Airworthiness.

Air Engineers and pilots operating aircraft as described in Paragraph 6 must at once satisfy themselves as far as is possible by external examination of the tubes that their particular aircraft are airworthy in this respect.

**T/14/34**

**28/6/34**

**GENET ENGINES GL5 AND SG7  
MODIFICATION OF B.T.H. MAGNETOS  
A.M. No. 37 1933**

Cases have occurred where the earth contact in the moulded contact breaker cover has not been in contact with the contact breaker fixing screw, due to the binding of the spiral spring in its socket. This breaks the continuity of the earth circuit, making it impossible to switch the magneto off.

In order to eliminate the above mentioned risk, a modified type of earth contact has been designed and is covered by Civil Modification B.T.H. No. X-1.

This modification is to be incorporated at the earliest opportunity.

The Certificate of Airworthiness of any aircraft affected by the above modification will be liable to suspension or cancellation if the modification has not been effected within three months of the date of this notice. Certificates of Airworthiness will not be renewed and air engineers must not sign Daily Certificates in respect of such aircraft after the expiration of the aforementioned period unless the modification has been correctly carried out.

The part necessary, which consists of a "C" type spring for contact breaker cover drawing Number CX 52972, is obtainable through Armstrong Siddeley Motors, Limited, Slater Street, Ottawa.

**T/15/34**

**29/6/34**

**SOLID METAL AIRSCREWS—RECONDITIONING**

Damaged metal airscrew tips may, in many instances, be removed and the ends refinished without material loss of efficiency provided that the resultant diameter is not reduced beyond 10 per cent of the original and the refinishing and the balancing are satisfactory.

Operators must satisfy themselves that there is not material economic loss of performance and still must ensure that minimum airworthiness performance requirements are fulfilled to the satisfaction of Departmental representatives.

Reduction of airscrew diameter entails alteration in pitch setting. It is essential to have both blades of an adjustable pitch airscrew set accurately to the same angle in order to obtain optimum performance and to avoid unbalanced forces with their dangerous consequences. When once set, no alteration in pitch is advisable unless adequate facilities exist for checking.

T/17/34

8/9/34

### **GIPSY ENGINES MARK I AND II— ROCKER VALVE GROUP**

Valve Rocker Arm, Part No. 802-36A, is drilled longitudinally from the pivot bearing to the ball end adjacent to the valve to conduct oil to this ball and fitting. The modified version of this Rocker Arm is Part No. 802-36B which is fitted with a hardened "pad" instead of a ball end and is *not* drilled longitudinally.

Instances have been discovered in which Rocker Arms, Part No. 802-36A (drilled) have been modified by replacing the original ball end fitting with the "pad" type fitting, thereby considerably weakening this part and resulting in a fracture adjacent to the "pad."

It is considered to be of the utmost importance that all Gipsy Mark I and Mark II engines are inspected and that in all instances where Part No. 802-36A (drilled) has been modified to the "pad" type, that this type of Rocker Arm be replaced *immediately* by Part No. 802-36B, that Part No. 802-36A be regarded as obsolete.

T/18/34

1/10/34

### **B.T.H. MAGNETOS, TYPES A.V., S.V. AND S.C.— PROTECTION OF CONTACT BREAKER ROCKER ARM SPRINGS AGAINST CORROSION—A.M. No. 26, 1934**

Contact breaker rocker arm springs for the above magnetos should be straw colour when fitted; a blue discoloration indicating corrosion, at first in irregular patches, and ultimately uniformly over almost the entire length of the spring, may occur after a short period in service, followed by failure of the spring.

All contact breaker rocker arm springs should be examined and, if free from signs of corrosion, varnished with flexible, air drying, synthetic resin varnish, in accordance with the procedure described in the succeeding paragraph. Springs showing any signs of corrosion should be replaced by new varnished springs.

The main and auxiliary springs should be removed from the contact breaker and washed in gasoline to remove all traces of grease. A thin even coat of varnish should then be applied to both sides and edges of the springs with a clean brush and the springs hung up separately to dry at room temperature for twenty-four hours. No varnish should be applied to the contacting faces of the springs, which should be cleaned and polished bright to ensure good electrical contact.

The springs should be re-examined regularly at frequent intervals and any found to be discoloured, whether owing to failure of the varnish coating or otherwise, should be rejected. The varnish should be renewed, when necessary, on springs free from corrosion, i.e., if cracking, flaking, or accidental scoring of the varnished surface has occurred. The old varnish must not be removed by scraping, but by immersion for two or three seconds in dope solvent and wiping with a clean rag.



The Certificate of Airworthiness of any aircraft fitted with magnetos of the types referred to will be liable to suspension or cancellation if the action herein described has not been taken within three months of the date of this Information Circular. Certificates of Airworthiness will not be renewed and Air Engineers must not sign daily certificates in respect of such aircraft after the expiration of the aforementioned period unless the work has been correctly carried out.

T/19/34

25/9/34

### **B.T.H. IMPULSE STARTERS, TYPE L**

**A.M. No. 27, 1934**

Failures of the above impulse starters have occurred from inadequate lubrication and due to the locking washer under the main fixing nut binding on the body.

Impulse starters fitted to base mounted magnetos should be lubricated every 25 hours with 8 to 10 drops of thin machine oil introduced through the hole in the side of the impulse starter. Impulse starters on spigot mounted magnetos, being contained within the engine casing, normally receive sufficient lubricant.

A hardened steel distance washer, part No. CX 55223, has been introduced by B.T.H. modification No. L. 1 to be fitted underneath the tab washer, part No. CX. 53096, and the main securing nut, part No. CX. 53095, in order to ensure perfect freedom of movement between the body and the hub by eliminating any possibility of the tab washer binding on the body. The new washer and further details of the modification can be obtained from Messrs. British Thomson-Houston Co., Ltd., Alma Street, Coventry, England. It is recommended that the modification be incorporated on the next occasion on which impulse starters are dismantled.

Impulse starters of the above-mentioned type should be dismantled and examined internally for wear every 400 hours, attention being given to the following details:—

- (a) The driving member should be replaced if the stops have worn more than 50 per cent of the diameter of the stop.
- (b) The hub should be replaced if the wear in the slots exceeds 1 millimetre. Any burrs round the slots should be removed before re-assembly.
- (c) The bearing pins for the pawls should be extracted and, if the wear on the pin or in the hole exceeds .010 inch, the parts should be replaced.

T/21/34

25/10/34

### **COCKPIT AND CABIN HEATERS—INSPECTION**

Owing to the recurrence of reports of carbon monoxide gassing from faulty exhaust pipes and cabin heaters, attention is drawn to the necessity for frequent and rigid inspection of exhaust pipes to make sure that there is no leakage through to the hot air ducts.

Nearly all modern cockpit and cabin heater equipment makes provision for easy inspection by removal of the hot air collector. It is desirable, however, to bear in mind that corrosion starts on the inside of exhaust pipes and works outwards and so it is reasonably possible to take adequate precautions by internal examination of the exhaust manifold extension pipe.



**T/22/34**

**22/12/34**

**FAIRCHILD—MODIFICATION TO STABILIZER  
SUPPORT**

The stabilizer front support arm in Fairchild FC, 2, FC. 2W2, 51, 51/71 and 71 type aircraft is to be immediately inspected for evidence of fractures across and under the boss at the apex of the pressing. If found defective, immediate replacement must be made with modified part number C 1004 x 4 revision B. If not defective, it may be continued in service with frequent inspections until April 30, 1935, when replacement is to be made.

Certificates of Airworthiness for aircraft of the above mentioned types will not be issued or renewed, nor may Air Engineers certify such aircraft airworthy after April 30, 1935, unless this modification has been satisfactorily embodied.

**1935**

**T/1/35**

**5/1/35**

**GIPSY MAJOR ENGINES WITH METAL AIRSCREWS  
IN "D.H. DRAGON" AIRCRAFT A.M.  
No. 36 AND 38, 1934**

Engines fitted as above have been found to develop defects in the airscrew boss and crankshaft due to "fretting" which in time may lead to failure of the crankshaft, and the use of metal airscrews, as above, is to be discontinued. Any such engines are to be immediately examined (microscopically at the crankshaft) and defects dealt with, if not pronounced, by polishing out as recommended in DeHavilland Aircraft Co., Circular Letter Reference AJB/JED/1305 of October 25, 1934. Hubs of new design—Part No. 1900/SB—are to be fitted immediately and in any case not later than March 31, 1935. Until they are obtainable, the above examination is to be repeated at each 25 hours' flying.

At the time of replacement of the hub, the inspection is to be repeated and thereafter at 10, 50 and 75 hours' running and records of all such examinations placed in the engine log books.

New crankshafts to Drawing No. 1300/1A are also to be fitted to engines used as above as soon as they are obtainable and not later than the completion of 750 hours' running, except in the case of overhauled engines where this period will be 1,100 hours; in all cases replacement is to be made before April 30, 1935.

Certificates of Airworthiness will not be issued or renewed and air engineers are not to sign such engines airworthy after the above dates unless these modifications have been embodied.

**T/2/35**

**14/2/35**

**GIPSY MARK III AND MAJOR ENGINES FITTED  
WITH D.H.A.C. FUEL PUMP A.M. No. 3, 1935**

One or two instances of gas lock in the fuel system of engines fitted with D.H.A.C. pumps, when operating in tropical countries, have been reported. This defect only occurs following a flight and when the engines have been allowed to stand for a short period before taking off again.

It has been established, by experiment at the constructors' works, that by reducing the strength of the spring on the fuel pump inlet valve, this defect is minimized.

The inlet valve spring Part No. A.10-23, which has 12 coils, is, therefore, to be discarded and replaced by a spring of the same type and strength as that used on the delivery valve; this spring has 16½ coils and is to Part No. A.10-28.

Four small air vent holes are to be drilled in the engine air scoop to assist in cooling the pump body and filter bowl in flight.

The foregoing modifications should be made to DeHavilland Drawing No. S.K. 4653.

These modifications should be embodied as soon as possible and in no case later than three months from the date of this Notice.

Certificates of Airworthiness of the Aeroplanes concerned will be liable to suspension or cancellation if the modifications have not been carried out within the above-mentioned period. Certificates of Airworthiness will not be renewed and Air Engineers must not sign Daily Certificates of Safety for Flight in respect of such aircraft after the expiration of this period unless the work has been correctly carried out.

**T/4/35**

### **FLEXIBLE BONDING CONNECTIONS** **A.M. No. 6, 1935**

**11/3/35**

Flexible bonding connections joining fixed and movable parts are liable to failure in fatigue after intensive use.

Such failures interfere with the operation of radio apparatus and may lead to sparking.

Ground engineers must pay particular attention to such flexible bonding connections on aircraft carrying radio apparatus and must ensure that such connections are intact before signing Daily Certificates of Safety for Flight.

Suitable forms of connecting cables for this purpose are shown in Air Ministry Specification G.E. 125 as follows:—

“Flexible bonding leads are to consist of braided flexible copper conductors of approximately circular section made up in one of the following ways:—

- (i) A braided conductor composed of 16/5·004 in. with a core consisting of 105 strands of ·0032 in.;
- or
- (ii) A coreless braided conductor consisting of 16/4·0048 in. Each strand of the conductor shall be bare annealed copper wire of the stated diameter to British Standard Specification No. 128. Single strands may be soldered but no joints are allowed in the braided conductor.”

**T/5/35**

### **D.H. PUSS MOTH—CABIN ROOF BRACING**

**20/6/35**

Reference Air Ministry Notice to aircraft owners and ground engineers No. 46 of the year 1933.

An additional roof bracing to Drawing No. M.1963 issued by the DeHavilland Aircraft Company Limited is to be fitted to all Puss Moth aeroplanes having the original type of curved Vee bracing tube. This additional roof bracing must be embodied before next renewal of certificate of airworthiness.



Pending its installation, cabin roof bracing is to be examined at close intervals, more particularly after the aeroplane has suffered severe loads in landing or taxiing. If any defect is found, no further flying is to be carried out until all defects have been repaired and the additional cabin roof bracing to Drawing No. M.1963 has been fitted.

**T/10/35**

**5/9/35**

**GIPSY III AND MAJOR ENGINES, WITH D.H.A.C.  
FUEL PUMPS—A.M. No. 21, 1935**

Corrosion has been observed to occur between the gauze and the body in the filter chamber of the D.H.A.C. fuel pump.

Investigation has shown that the corrosion is associated with the presence of water, a contributory condition being the storage of the engine for several weeks prior to installation and preparation for flight.

It is very unlikely this condition will develop during normal operation when the parts are continually washed by the flow of fuel and cleaned after approximately each 25 hours' flying during routine maintenance.

Operators are requested, however, to exercise vigilance with regard to this matter, particularly if an engine has been standing off service for some time.

The copper and brass filter gauze will be replaced on future production by stainless steel gauze. This new gauze is obtainable from DeHavilland Aircraft of Canada, Limited, Toronto, Ont., by quoting the serial number of the engine concerned.

The new stainless steel gauze must be fitted at the first complete overhaul after this date or before the renewal of the Certificate of Airworthiness and, in any event, within six months of this date.

After the above mentioned dates, air engineers must not certify as airworthy any engine affected unless it has been satisfactorily modified as above indicated.

**1936**

**T/2/36**

**27/4/36**

**B.T.H. IMPULSE STARTERS TYPE L.  
A.M. No. 10, 1936**

Information Circular No. T/19/34 refers to the permissible wear of the stops which retain the impulse unit in position during normal running of the engine, i.e., when the unit is inoperative.

This wear has the effect of increasing the degree of advance of the ignition timing, and it is important that the advance shall at no time exceed that quoted in the instruction book.

The timing should, therefore, be periodically checked and, if necessary, reset by means of the vernier coupling.

All details of the result of each examination should be entered in the log book, with particular reference to any adjustments made. An indication will thereby be provided of the extent, if any, to which the stops have worn.

Certificates of Airworthiness of any aircraft fitted with impulse starters of the above-mentioned type, will be liable to suspension or cancellation if the requirements detailed in Paragraphs 2, 3 and 4 have not been complied with within three months of the date of this Circular. Air Engineers may not certify as airworthy aircraft affected after the expiration of the above-mentioned period unless the requirements have been complied with.



**T/3/36****28/4/36****MASS BALANCING OF AILERONS AND RUDDERS****A.M. No. 12, 1936**

In order to obviate tendencies to flutter of ailerons and rudders, these surfaces are usually mass-balanced by means of internal or external balance masses, so located as to bring the centre of gravity of the surfaces forward.

It is of great importance that no additions should be made to the surfaces referred to, whether in the course of repairs or otherwise, which will tend to nullify the existing condition of balance, since this may induce flutter and possibly, consequential failure in the air. These considerations apply equally to surfaces with and without balance masses.

Any material addition of weight aft of the hinge line of an aileron or rudder, such as the installation of a tail light, is regarded as a modification affecting the safety of the aircraft, and an aircraft so modified must not be flown until the modification has been approved by the Department of Transport.

**T/4/36****28/5/36****D.H. 60M AND TIGER MOTH AIRCRAFT REAR  
FUSELAGE INSPECTION**

Owing to racking loads from the tail skid, the bottom longerons of the metal fuselage of Moth Gipsy and Tiger Landplanes may become defective at or near the ends of the transverse gusset plates between the port and starboard longerons immediately in front of the sternpost.

All Moth and Tiger landplanes of the above-mentioned types are to be examined immediately to ascertain that the four longerons in the skid bay are not defective. Although cracks are not expected to be found in the top longerons, these members are to be examined at the same time as the bottom longerons.

**T/6/36****10/12/36****D.H. MOTH 60M—HOOK FOR SLING**

The slinging hook, H24834 on Part No. H24180-A located at Joint C on the front fuselage GA2153, has been found broken in two or three instances, and at least two accidents have occurred as a result of this type of failure.

All owners are advised that the slinging hook must be removed and the complete joint inspected carefully. Where any wear has occurred in any portion of the bolt or fittings, or where the length of the threaded portion on the bolt has not been cut correctly, one of the following modifications, shown on DeHavilland drawing DHC1342, must be adopted:—

- (a) The diameter of the hook bolt to be increased from  $\frac{5}{16}$  inches to  $\frac{3}{8}$  inches, and the appropriate holes reamed accordingly.
- (b) The diameter of the hook bolt to be increased from  $\frac{5}{16}$  inches to  $\frac{11}{16}$  inches, and the appropriate holes reamed accordingly.
- (c) The existing  $\frac{5}{16}$  inch hook bolt to be replaced by an oversized  $\frac{5}{16}$  inch diameter hook bolt.

If the modified hook bolt is not obtainable, a bolt of the dimensions indicated may be fitted provided it has been supplied by the manufacturer of the aircraft or his agents.

All D.H. Moth 60M aircraft at present registered in Canada must be inspected immediately, and the onus of deciding which of the above modifications is necessary becomes the responsibility of a licensed ground engineer. Particular attention should be paid to ensure that no load is being taken on the threaded portion of the replacement bolt. All items which comprise the above modifications may be obtained from the De Havilland Aircraft of Canada Ltd., Station "L," Toronto.

No certificate of airworthiness will be renewed after March 10, 1937, unless the necessary modification has been incorporated satisfactorily. This ruling applies only to aircraft which show wear or damage to the hook bolt or fittings.

**T/7/36**

**30/12/36**

**D.H. TIGER MOTH—MODIFICATION  
A.M. No. 42, 1936**

Details of a modification to the attachment fittings at the root end of the top rear spar, Part No. H. 34746/7, on D.H. 82 ("Tiger Moth") aeroplanes, are given in DeHavilland Technical News Sheet No. 203. Owners or operators of such aeroplanes, or air engineers concerned with their maintenance should apply to DeHavilland Aircraft of Canada Ltd., Toronto, Ont., for a copy of this publication.

An immediate inspection of the above-mentioned parts must be carried out, attention being directed to cracks in the portion bent to form the eye for the attachment pin. This part of the fitting can be exposed by opening up the fabric over the extreme root end of the top rear outer spar. Repeat inspections must be made every 25 flying hours until modified fittings are available. If defects are found, the aeroplane must not be flown until replacement fittings to Part No. H. 34746/7, Issue 6, are fitted.

Certificates of Airworthiness of the aeroplanes concerned will be liable to suspension or cancellation if the modification has not been effected within 4 months from the date of this Notice. Certificates of Airworthiness will not be renewed and air engineers must not sign Daily Certificates of Safety for Flight in respect of such aeroplanes after the expiration of the afore-mentioned period unless the modification has been correctly embodied.

**1937**

**O/42/37**

**20/10/37**

**REQUESTS FOR AIR ENGINEER'S AUTHORITY**

Air Engineers holding (b) and (d) certificates will normally be required in future to pass examinations before additional types of aircraft or engines are endorsed on their licences.

Temporary (b) and (d) authority will not normally be granted, except under special circumstances, and Air Engineers who require same to sign out aircraft or engines after structural repair must apply far enough in advance to the District Inspector to enable him to forward their requests to Headquarters with his recommendations.



**FAIREY-REED METAL AIRSCREWS**

Instances have occurred of transverse fatigue failure of the blade sheet of Fairey-Reed metal airscrews, the fractures commencing at the holes for the hub bolts or the bolts securing the hub blocks and extending towards the leading and trailing edges.

As the result of these failures, it is necessary that, in future, periodic detail inspection of these airscrews in the vicinity of the hub blocks and identification marks be made.

This detail inspection is to be made, after each period not exceeding 200 hours' flying, of all Fairey-Reed metal airscrews. A similar inspection is also to be made, after each intermediate period not exceeding 50 hours' flying, of the airscrews enumerated in list (a), and of any of those listed in list (b) which may be declared serviceable by the makers.

These inspections are additional to the normal routine inspections, during which the exposed parts of the blade sheets must be carefully examined for cracks, particularly in the vicinity of the blade roots and of the deeply impressed identification marks which appear on a few early airscrews of this type.

For the purpose of detail inspection, the airscrews are to be removed from the hubs, spinners from the airscrews and boss blocks from the blade sheets. The blade sheets are then to be cleaned and inspected for cracks, particularly in the vicinity of the bolt holes and in regions where any attrition or corrosion has occurred. This inspection is to be made with the aid of a magnifying glass. Inspection for cracks is facilitated by anodic treatment of the blade sheets, and if this treatment has not already been given, it is advisable for the blade sheets to be anodised as soon as this can be arranged.

Any airscrews found to contain cracks are to be withdrawn from use, and the matter is to be reported to the Controller of Civil Aviation, Department of Transport, Ottawa.

If no cracks are found, any attrition or corrosion marks are to be removed from the blade sheet and boss blocks by means of coarse emery followed by fine emery, and the airscrews are to be re-assembled. During the latter operation, a layer of tung oil varnish is to be inserted between the blade sheet and the boss blocks and care is to be taken to ensure even tightening of the bolts locating the blocks. When the bolts removed are of the obsolete type in which the nuts are secured by riveting, these are to be replaced by new bolts and self-locking nuts obtainable from the Fairey Aviation Co. Ltd.

When spinners are being re-assembled, care is to be taken to ensure that there is sufficient clearance between the blades and the spinner body to prevent chafing.

After re-assembly and prior to further use, the airscrews must be checked for blade angles, track, alignment and static balance, if facilities are available. The blade angles at three-quarters of the maximum radius must not differ by more than  $0^{\circ} 10'$ . The difference between blades, in track and alignment measured at the tip, must not exceed  $\frac{1}{16}$  inch and  $\frac{1}{4}$  inch, respectively. The error in balance must not exceed 5 inch-ounces. Should facilities for the above tests not be available, ground tests on the engine, and if these are satisfactory, flight tests, are to be made to ascer-



tain if the airscrew runs smoothly. If rough running is experienced, the airscrew is to be removed from the hub, and the location bolts slacked off and then re-tightened. If, on further tests, rough running still persists, the airscrew is to be returned to the makers or their agents.

List (a)—

The airscrews which are to be subjected to detail inspection after periods not exceeding 50 hours' flying are those numbered as follows, each number being prefixed by the letters "F.R." :—

371	1247	1469	1496	1566	2079
372	1248	1470	1498	1567	2080
491	1413	1471	1500	1568	2081
817	1414	1472	1502	1569	2082
927-H	1415	1473	1504	1570	2083
950	1425	1474	1505	1760	2085
1135	1427	1475	1506	1761	2101
1189	1429	1476	1507	1762	2103
1191	1460	1477	1508	1862-H	2105
1193	1461	1481	1509	1863-H	2274
1204	1462	1484	1510	1864-H	2278
1205	1463	1487	1512	1865-H	2321
1233	1464	1488	1513	1925-H	2323
1243	1465	1491	1515	1929	2324
1244	1466	1493	1560	2036	2326
1245	1467	1494	1561	2038	2327
1246	1468	1495	1564	2039	2686

and any of the airscrews quoted in list (b) which are declared serviceable after inspection by the makers.

List (b)—

Airscrews of obsolescent design, in view of their age and the possible repairs or adjustments made, are to be withdrawn from use forthwith and returned to the makers for inspection, when their serviceability will be further considered. These airscrews are numbered as follows, each number being prefixed by the letters "F.R." :—

238	1146	1250	1485	1565	2040
247	1188	1418	1492	1571	2084
314	1208	1419	1497	1757	2086
333	1210	1424	1511	1758	2104
489	1214	1428	1514	1759	2276
500	1227	1479	1516	1866H	2279
969	1241	1480	1562	1867H	2325
1136	1242	1482	1563	1924	2328

The Certificate of Airworthiness of an aircraft affected by this Notice will be liable to suspension or cancellation unless the first detail inspection has been made, or, where applicable, the requirements of list (b) have been fulfilled within three months of the date of this Notice: exception will be made where airscrews other than those quoted in lists (a) and (b) have not yet completed a total of 200 hours' flying, the allowable period being extended until this amount of flying has been completed. Certificates of Airworthiness will not be renewed and air engineers must not sign Daily Certificates of Safety for Flight in respect of such aircraft after the expiration of the afore-mentioned periods, unless the requirements of this Notice have been fulfilled.

If damage occurs to Fairey-Reed metal airscrews, repairs must be effected at the maker's works, or other repair shop approved for this work, except when the repairs are confined to the removal of scratches and sharp nicks.

(Extract from G. E. Notice 1/1937)

T/4/37

2/6/37

### HANDLEY PAGE SLOTS

Certain aircraft used for instructional purposes and fitted with Handley Page slots have had these slots either temporarily or permanently fastened down to facilitate practice in spinning.

It is known that these same aircraft are used for practice flying and passenger flights while the slots are still restrained. This is considered bad practice as the function of this safety equipment is to prevent or delay the stalling of an aircraft and consequently should always be available for use, except when the aircraft is to be used for spins.

Operators of aircraft so equipped are therefore cautioned to fit the restraining fastenings in such a manner as to permit the ready loosening of the slots when the aircraft is to be used for general flying.

T/5/37

23/8/37

### HAMILTON STANDARD AIRSCREWS

Light alloy airscrew blades have an indeterminate limit of life beyond which the likelihood of failure by fatigue becomes ever more present. Failure usually starts with a small crack just out of sight inside the hub on the trailing portion of the blade root. The crack increases progressively until the section of the blade root is so reduced that it can no longer resist the forces imposed and the blade flies off suddenly.

A thorough inspection requires that an airscrew be completely dismantled, and even then the detection of an incipient fatigue crack is a very difficult matter. There is no certain knowledge of the rate of progress of the failure from the time a crack is first formed to the time the airscrew is completely destroyed because no one would deliberately keep an airscrew blade in service once a crack had been detected. There is, however, reason to believe that the rate of progress may be extremely rapid and the whole process will almost always be completed well within the normal period between routine inspections.

In view of the uncertainty attendant upon inspection, it becomes necessary to resort to some other method for judging the probable airworthiness of an airscrew. To this end the Hamilton Standard Company has, as a result of statistical studies, been able to make recommendations as to the safe life of airscrew components of its make. These recommendations are given in the appendix to this circular but, of course, their application involves a record of airscrew life.

When an airscrew component has served to the limit of the recommended safe life, it should be considered as having reached a stage when full reliance cannot be placed upon inspection and, consequently, it should not be used any more without reference to the manufacturer.

Aircraft operators are urged to keep an accurate log of the history of each airscrew in their possession, and, as a corollary, are warned against the purchase of second-hand airscrews or components with an unknown or unreliable history. It is particularly important that, when an airscrew is sent in for repairs and servicing, it should be accompanied by a statement as to its life; otherwise the makers, or their agents, cannot assume responsibility for any pronouncement as to subsequent airworthiness.



When considering the matter of safe life of Hamilton Standard adjustable airscrew blades and hubs, the subject of severity of service must be taken into account as a distinct factor apart from design characteristics. Such factors as rough plane-engine-airscrew combinations, abnormally high cruising R.P.M., airscrew overlap, operations from cinder runways tend to decrease the safe life of the airscrew. Airscrews subjected to severe use should be frequently inspected and serviced to guard against the possibility of tip failures. Blade surfaces should be kept in good condition, and erosion due to water spray or cinders should be promptly removed. When thickness and width for the outer 12" tip section has been reduced in excess of 10%, blades should be reduced in diameter so as to regain thickness and width within the proper limits, or the blades should be retired from service to prevent a tip failure resulting from flutter.

Anyone having a Hamilton Standard blade or hub not mentioned in the appendix to this circular is requested to communicate with this Department through the appropriate District Inspector for reference to the manufacturer as to safe life.

There are certain airscrew blades of obsolete design which are more subject to fatigue failure than those of later design. Generally speaking, the older designs may be identified by a rather abrupt change in shape from the cylindrical butt portion to the aerofoil section of the blade.

While the list of blades and hubs in the "two thousand hour or less" category is fairly long, it is expected that the actual number due for retirement in Canada will prove to be quite small. Operators are, however, advised that, owing to pressure of business, delivery on blades and hubs is at present from three to five months and therefore orders for replacements should be placed well in advance of the time expiry of parts in service.

The following Hamilton Standard blades and hub are now considered obsolete by U.S. Department of Commerce and should be discarded:—

Blade	1546	Serial Numbers	16457 and 16458
Blade	H1221	Serial Numbers	12542 and 12543
Hub	5006	Serial Number	8849

Air Engineers are not to certify as fit for flight aircraft fitted with the above blades and hub after fifteen days from the date of this notice.



## APPENDIX TO

### C.C.A. INFORMATION CIRCULAR No. T-5/37

#### Recommendations of the Hamilton Standard Company as to the safe life of airscrew components of their manufacture.

Blades bearing manufacturing numbers 39213 and over could have a safe limit of life of three thousand hours for single engined airplanes and for installation on the centre motor of tri-motored airplanes. For outboard motors the blades should be retired at two thousand five hundred hours.

Blades bearing manufacturing numbers prior to 39213, with the exception of designs noted below, should be retired from service after operating two thousand hours in single engined airplanes. For outboard motors the blades should be retired at two thousand five hundred hours.

<i>Blade Design</i>	<i>Recommendation</i>
***A1C1, ***D7C1 $\frac{1}{2}$ , *25V2, *26V2, *19V2, †5B1, **19B $\frac{1}{2}$ , *19BO, ***A3A1, ***33C1 $\frac{1}{2}$ , ††17A2, ††43A2, *13BO, †11C1, ***2A1, ***7C1 $\frac{1}{2}$ , ***1A1.	A safe limit of 300 hours for single engined airplanes and centre motor installations on tri-motored airplanes. For outboard motor installation this limit should be reduced to 2,500 hours.
***1027, ***1027X, ***1567, ***1887, ††H1207, †1519, ***1803, †1611, ††1503, ***1582, ††27C1, ††1301, †1546, **1105.	Recommend retirement at 2,000 hours. If conditions or records indicate severe service or if they have been bent in accident, we recommend retirement at once.
9C1, 1911.	Blades are old Navy design and experience has indicated that the fairing is conducive to fatigue failures. We would recommend replacing these blades with our design A1C1 which incorporate much better fairing.
***H1425, ***1C1, ***H1407, ††1507.	While these designs are superior to the 9C1, they still incorporate very poor fairing and we would recommend replacing at 1,500 hours, or at once if any of the blades have been involved in an accident necessitating a major repair.

- \* Not to be used on single row radial engine with bore exceeding 4.375".
- \*\* Not to be used on single row radial engine with bore exceeding 4.875".
- † Not to be used on single row radial engine with bore exceeding 5.19".
- †† Not to be used on single row radial engine with bore exceeding 5.25".
- \*\*\* Not to be used on single row radial engine with bore exceeding 5.75".
- ††† Not to be used on single row radial engine with bore exceeding 6.125".

Hubs of the following numbers we recommend a safe life of 3,000 hours:—

5406	5408	5407
7033	5413	5414
5404	5903	5976

Hubs of the following number we recommend a safe life of 2,500 hours:

7056 (bore limit 4.875")

Hubs of the following numbers we recommend a safe life of 2,000 hours:

2450	5006
1518	1595
1693	

(No. 1693 above to be used only on engines with less than 330 H.P.)

Hubs of the following number we recommend a safe life of 1,500 hours:

5131

The following hub, No. 5003, has a tendency to crack along hub spline from centreline of blade out—replace at once.

It is, of course, understood that hubs and blades should not be used on engines having higher horsepower, r.p.m., or bores than are specified as a maximum by the A.T.C. for the hub and blade in question.

**T/6/37**

**14/12/37**

### **CORROSION—AIRCRAFT WHEEL HUBS**

An instance has been observed of corrosion of the cast magnesium material of an aircraft wheel hub, where it was in contact with the bead of the tire casing, of such severity that condemnation of the part was necessary.

The aircraft had been in service near the sea coast for only fifteen months, and there is little doubt that the rapid corrosion was mainly attributable to the salt sea air.

Owners are advised to make periodic inspections of such aircraft wheel hubs at least once yearly inland and twice yearly in coastal districts.

**T/8/37**

**29/12/37**

### **AIRCRAFT EQUIPMENT—SERVICEABILITY**

The responsibility of an Air Engineer licensed in (a) or (b) categories when certifying as to the fitness for flight of any aircraft, includes all equipment and instruments installed in such aircraft both as to their correct functioning and general serviceability.

Instances are occurring of fire extinguishers found empty, or nearly so. Frequent inspection is essential as the pump handle may work loose or become displaced, permitting the liquid to leak out. The effectiveness of extinguishers should also be periodically verified after which the extinguisher should be refilled.

**1938**

**O/36/38**

**25/6/38**

### **REFUELLING AIRCRAFT FIRE PRECAUTIONS**

The necessity for greater precaution against fire hazards while refuelling aircraft is called to the attention of all concerned. The loss of aircraft and property by fire through carelessness has reached alarming proportions.

An aeroplane recently caught fire during refuelling. Investigation showed that the aircraft, a seaplane, was being refuelled at the wharf. One tank was allowed to overflow and a considerable quantity of gasoline spread over the surface of the water. A bystander, standing near the aircraft, carelessly threw a lighted match in the water, igniting the gasoline and causing considerable damage to the aircraft and surrounding property.

The following minimum precautions should be enforced by owners and operators when aircraft are being refuelled, and recommended as a basis for local refuelling regulations.

- (a) No smoking within fifty feet of the aircraft being refuelled. At licensed airports and bases "No smoking" signs should be displayed in prominent places.
- (b) The engine should be stopped, switches in an "off" position, and the engine cooled.
- (c) The power on all radio transmitters and receivers should be off.
- (d) The refuelling equipment and the aircraft must be grounded. Refer. T/3/34.
- (e) Gasoline should not be permitted to overflow from the tank. In hot weather, tanks should not be completely filled with cold gasoline which will subsequently expand and overflow. Gasoline will float and burn on the surface of water.
- (f) Only those responsible for the refuelling or the maintenance of aircraft should be allowed within fifty feet of the refuelling operation.
- (g) No aircraft should be refuelled in hangars.
- (h) A good felt strainer is preferable to a chamois.
- (i) No refuelling during Winter flying operation while the engine is being warmed.
- (j) Fire extinguishers should be within easy reach of those refuelling.
- (k) When starting the engine, special care should be taken not to overdope, and if the aircraft is not fitted with a pressure type of fire extinguisher, it is a wise precaution to have a man present outside the aircraft with a portable fire extinguisher.
- (l) In the event of a backfire, endeavour to keep the engine turning over so as to suck the flames up into the air intake.

It is the responsibility of licensed pilots, air engineers, aircraft and airharbour owners and operators to see that reasonable fire prevention measures are enforced during the refuelling of aircraft. In future, any negligence on the part of those responsible will be considered sufficient cause for the suspension or cancellation of certificates as issued under Air Regulations.

O/46/38

13/7/38

#### **CIVIL AVIATION DISTRICT INSPECTORS— BUSINESS OFFICE HOURS**

The office hours of District Inspectors are from 9 A.M. to 5 P.M. with the exception of Saturdays, which are from 9 A.M. to 1 P.M.

Aircraft operators and personnel desiring examinations, flight tests, issue or renewal of certificates and licences, are requested to arrange to transact their business during office hours. In future this work will not be done out of office hours, except under special circumstances.



**T/2/38**

**18/1/38**

### **WELDING REPAIRS TO AIRCRAFT ENGINES**

Welding repairs to aircraft engines are on no account to be done except in a shop properly equipped for the work and for the subsequent accurate checking of the dimensions and alignment of the repaired component.

Welding repairs will only be allowed at lightly stressed regions of a component where there is no danger of distorting the alignment of machined faces.

Every repair is to be treated as an individual case and written authority for its execution is to be obtained from the Resident Inspector, A.I.D., of the District concerned. The exact nature and location of the repair and the authority for its execution are to be fully recorded in the engine log book.

**T/3/38**

**29/1/38**

### **AIRWORTHINESS OF AIRCRAFT INSTRUMENTS AND EQUIPMENT**

The duties and responsibilities of Air Engineers in connection with the daily certification of aircraft include the care of all instruments and equipment which are required to be installed both by the certificate of airworthiness and the licence for scheduled air transport service. The question of responsibility for radio equipment is now under review but until further notice in this connection, Air Engineers must accept responsibility that aircraft fitted with radio are not rendered unairworthy by its installation or operation.

In view of the growing importance of instruments in present day air transport, it is advisable for all Air Engineers to acquire further knowledge of the functioning and adjustment of instruments. This information can be obtained through the manufacturer of the aircraft or direct from the instrument maker.

**T/5/38**

**18/2/38**

### **TESTS FOR AIRFRAME WELDERS**

Information Circular T/1/38, "Tests for Airframe Welders," and the appendix to the publication "Information Circulars to Air Engineers and Aircraft Owners, January 1, 1928 to June 30, 1937," entitled "Welders," are hereby cancelled.

The service offered in the past has achieved its object, and, as the Department of Transport does not issue licences to aircraft welders, it is no longer prepared to test welding specimens at the request of individuals.

It is still recognized that an aircraft welder requires constant practice to maintain the requisite standard of his work, but it is held to be the responsibility of the employer to ensure that the work of his employees conforms to the necessary standard. Employers are, therefore, urged to require, periodically, test specimens from the welders in their employ. These specimens can be sectioned and broken in the workshop for examination, which will reveal most of the defects attributable to workmanship. Only under special circumstances should it be necessary to submit specimens to a testing laboratory for report.

Private individuals who desire to check their skill at welding are advised to section and break their own specimens until a stage of proficiency is reached which would justify the cost of submitting samples to a testing laboratory for test and report. Such testing laboratories can usually be found at schools of engineering.

The assistance of the nearest Resident Inspector, A.I.D., from whom copies of the standard drawing for Weld Test specimens can be obtained, may be requested for advice and criticism of specimens, provided that no cost to the Department is involved.

The welding of aircraft structures must be certified as airworthy by a licensed "B" engineer, and the Department reserves the right to test the work of any individual engaged in welding aircraft structures by demanding the submission of specimens in accordance with the standard drawing.

**T/6/38**

**3/3/38**

### **UNDERCARRIAGE FAILURE—CUB J2 AIRCRAFT**

The recent failure of a Cub J2 undercarriage shock absorbing strut disclosed, upon inspection, that the inner sliding tube had worn the outer member to a considerable extent. A large segment of the open end of the outer tube was worn to a knife edge and, in the region where the inner sliding tube ends, and where the fracture took place, the wall of the outer tube was almost worn through.

Air Engineers responsible for this type of aircraft should inspect the undercarriage immediately for signs of wear. This can be done by removing the inner sliding tube, when the end of the outer tube can be measured. Signs of wear on the lower end of the sliding tube will indicate wear on the inside of the outer tube. Tubes which have worn more than 20% of the wall thickness should be renewed.

**T/8/38**

**9/3/38**

### **RADIO INSTALLATIONS IN AIRCRAFT**

#### **(Airworthiness Aspect Excluding Functional Efficacy)**

All aircraft manufacturers and operators are reminded that the installation of radio in an approved type aircraft constitutes a modification to an approved design which affects the safety and possibly the performance of the aircraft. The introduction of an unauthorized modification automatically invalidates the Certificate of Airworthiness.

Unless complete information is provided, it is impossible for the technical officers of the Department to judge whether or not either the safety or the performance of the aircraft has been affected adversely by the installation of radio. For instance, an aerial attachment on a control surface may affect the mass-balance of that surface and introduce flutter hazards. Again, a fixed loop attached to the fuselage immediately forward of the vertical tail surfaces may interfere adversely with the airflow and must be designed to possess adequate factors of safety in the attachment in order to obviate the possibility of failure and consequent fouling of the tail surfaces during flight. Fire hazards in the wiring system must be reduced to a minimum, and the use of radio apparatus and electrical fittings



of doubtful quality might endanger the safety of the aircraft. The weight distribution of the various parts employed in the installation may affect adversely the balance of the aircraft, and will certainly affect the empty and tare weight.

For the above reasons, each type installation must receive approval regarding the strength, weight distribution, fire risk and general airworthiness of the aircraft, and duplicate copies of drawings completely illustrating these points are required to be submitted to the Department for examination, accompanied by all calculations necessary to ensure satisfactory strength in attachments and in the main structure affected by concentrated loads in the system. These drawings, when approved, will form the basis for inspection and the signing and endorsing of any relevant release note or Certificate of Airworthiness.

Major modifications to an approved type radio installation must be regarded in the same light, that is, as a modification to an approved type design which requires complete formal approval.

T/9/38

15/3/38

### APPROVAL OF SKI INSTALLATIONS

At the present time there seems to be a certain amount of confusion amongst air engineers and aircraft operators regarding the approval of either complete ski installations or their individual components, and, in order to clear up any misunderstanding on this subject, the following requirements are promulgated.

Approvals respecting main and tail ski installations may be classified as follows:

- (a) A main ski base may receive a general approval for a certain maximum static load, subject to limiting positions and dimensions of the pedestal.
- (b) A pedestal may receive a general approval for a certain maximum static load.
- (c) The approval of a combination of ski base with pedestal is limited to that combination, and another approval must be obtained if use is desired with an alternative arrangement, even though the component parts of the combination may have been approved under (a) and (b).
- (d) The first installation of any given type of winter landing gear on a particular aircraft must receive separate approval, and this approval covers the aircraft structure and trimming gear in addition to the ski base and pedestal combination. Any modifications to either an approved installation, or an increase in aircraft gross weight, must receive subsequent approval. These approvals form the basis for inspection and certification of subsequent installations of similar type on the same type aircraft.

When a person has purchased either an approved ski base or an approved type pedestal, or a combination of both, and desires approval of the installation, duplicate copies of a drawing illustrating the complete installation and all details of the trimming gear and relevant fastenings must be submitted to the Department of Transport. In all cases, the C.G. position of the aircraft and the distance between the main undercarriage axle and the tail ski should be given.



Final approval of all type ski installations will be based on the results of tests performed by the applicant under the supervision of the Department. The report on these tests must include the following:—

- (a) Gross weight of aircraft at which tests are made.
- (b) Drawing number to which the ski installation has been designed.
- (c) Distance required to take off.
- (d) Height reached in 3 minutes from leaving the ground.
- (e) Behaviour of aircraft in flight.
- (f) Landing, taxiing and handling on the ground qualities.
- (g) Condition of ski installation after tests have been conducted.
- (h) Approximate wind velocity at time of tests.
- (i) Altitude of airport where tests made.

As from the date of this notice no drawings of any ski installation will be finally approved until the report on the tests outlined in para. 4 above has been received and accepted by the Department.

When the person holding the Department's approval for a given complete ski installation sells subsequent examples, the shipment must be accompanied by a release note certifying that the equipment conforms to the approved drawings, the numbers of which must be quoted.

Air engineers are reminded that before certifying a skiplane as air-worthy they must satisfy themselves that the ski installation has been approved by the Department. Renewal of certificates of airworthiness in respect of ski equipped aircraft will be interpreted as evidence of Departmental approval in respect of designs in present use.

**T/10/38**

**12/4/38**

### **STUDS AND MACHINE SCREWS IN CYLINDER HEADS AND OTHER LIGHT ALLOY CASTINGS**

Several instances have occurred recently of cracks developing in cast aluminum alloy cylinder heads, caused by the screws which secure the cylinder head baffle being too long.

The screws were forced home, with the result that the metal at the bottom of the hole was distorted and, from this distortion, cracks developed, extending across the head between the valve seats.

Air engineers responsible for engines fitted with cylinder head baffles are warned to examine their cylinder heads immediately.

The attention of all Air Engineers is drawn to the necessity for ensuring that holes are of proper depth, that they are tapped to their full extent, and that only studs or screws of the proper length are used when they are being fitted into light alloy castings.

**T/13/38**

**28/4/38**

### **AIRSCREW HUBS ON TAPER SHAFTS**

The recent occurrence of a failure of a taper airscrew shaft makes it advisable again to draw the attention of operators and air engineers to the necessity for scrupulous attention to the fit of airscrew hubs on taper shafts.

Attention is invited to Information Circular T-8-32.

The Engine Manufacturers' Maintenance Manuals usually include full instructions concerning the procedure necessary for ensuring a good fit to start with and maintaining this fit for service. These instructions must be followed in detail.

**T/14/38**

**28/4/38**

### **STRUCTURAL FAILURES—AIRCRAFT**

When a structural failure occurs either in an engine or an airframe, the owner or pilot is required by Paragraph 132 (2) of Air Regulations to give particulars of the damage. A structural failure is always a potential cause of an accident and, consequently, the Department of Transport desires, in the interest of safety, to receive an immediate and full report on every structural failure so that the cause may be ascertained, and, if possible, eliminated so as to avoid a repetition of similar failures. The defective parts constitute a portion of the most important evidence from which the cause of the failure may be determined and, therefore, they must be held for inspection by an official of the Department.

On no account may defective parts, which form a portion of the evidence respecting a structural failure, be sent out of Canada without the written permission of the Department. This permission may be solicited from the nearest Inspector of Civil Aviation, who will, at his discretion, refer the matter to Department Headquarters.

Defective parts must be preserved as nearly as possible in the state in which they were when the failure occurred. If the failure is of an important nature, for example, a broken airscrew, crankshaft, or a structural fitting, it is very desirable to make a photographic record at the first opportunity in order to preclude the chances of loss of evidence through any cause whatsoever.

A structural failure may be defined as the failure of any part of an aircraft by reason of which loss of sustentation, of control or of continuous propulsive effort might result. Damage by collision with external objects is not included.

**T/16/38**

**28/6/38**

### **U.S. SPECIFICATIONS FOR AIRSCREWS**

Information has been received from the U.S. Bureau of Air Commerce that the Hamilton Standard blade models listed below are those which cannot be repaired if straightening is required:

Model	A. T. C.	Model	A.T.C.
9C1..	320	1815..	320
9C1½..	322	1819..	320
9C2..	324	1841..	320
1407..	4	1863..	320
1409..	5	1865..	320
1425..	4	1905..	320
1503..	25	1909..	320
1529..	25	1911..	320
1558..	320	1917..	324
1574..	320	1943..	320
1582..	320	1961..	320
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**LICENCE TO CERTIFY THE AIRWORTHINESS OF AIRCREWS  
AFTER OVERHAUL OR REPAIR. (EXCEPTING FIXED  
PITCH SINGLE PIECE WOODEN AIRSCREWS.)**

1. Owing to the increasing complexity of the modern airscrews, marked not only by the greater complication of the mechanism but also by the selected qualities of the materials employed, the overhaul and repair of airscrews requires the supervision of persons having special knowledge and consequently, it has been decided that no person shall be empowered to certify the airworthiness of an airscrew after major overhaul or repair without a licence from the Department of Transport.

2. The licence may take the form of an endorsement of an existing Air Engineer's Certificate in Category B. or D. or, in the case of persons not holding such a certificate in good standing, a letter of authority from Headquarters of the Civil Aviation Division.

3. The operations, all or any of which constitute a major overhaul or repair, are:—

- (i) Assembly of new parts requiring fitting or machining operations.
- (ii) Rectification of distorted blades within cold straightening limits.
- (iii) Twisting blades of one piece metal airscrews.
- (iv) Grinding, polishing and trimming blades.
- (v) Inspection of blades by the aid of the etching or anodic process.

4. To be eligible for a licence to certify the airworthiness of airscrews after major overhaul or repair, a person must show proof of knowledge and experience described as follows:—

- (i) Knowledge of Air Regulations, Parts I, II, IV, XI and XII.
  - (ii) Knowledge of the meanings of engineering terms and phrases such as stress, strain, work, power, thrust, horse-power, centrifugal force, etc.
  - (iii) Elementary knowledge of the aerodynamic theory of airscrews.
  - (iv) Knowledge of the materials used in airscrew construction including chemical composition, methods of manipulation and heat treatment during manufacture, properties, identification, examination and testing.
  - (v) Specific intimate knowledge of the particular model or models of airscrew for which application for licence is made, including
    - General principles of construction and operation.
    - Inspection of finished parts for dimensions, weight balance, etc.
    - Correcting parts for weight and balance.
    - Dismantling and re-erecting.
    - Clearances and tolerances.
    - Discovery and rectification of defects.
    - Assembly to engine and check testing.
    - Adjustments for performance.
  - (vi) General experience in machine-shop practice of a length at least equal to that required for a B. or D. Certificate.
  - (vii) Special experience equivalent to at least one month's intensive training at the plant of a manufacturer of airscrews or at an approved airscrew repair shop.
5. (i) An applicant's qualifications will ordinarily be established by examination, but, in order to meet the immediate requirements of the industry, the Controller of Civil Aviation may in special cases waive examination on the production of satisfactory letters



of reference which must include a letter of approval from the manufacturer of the airscrew or his principal agent in Canada.

- (ii) The examination will comprise a written or oral check of the applicant's knowledge of Air Regulations followed by a written technical examination in two parts. Part I will consist of general questions dealing with the subjects specified in sub-paras. (ii), (iii), and (iv). Part II will consist of specific questions on the subjects specified in sub-para. (v) of Para. 4 of this circular.
- (iii) Holders of Air Engineer's B. or D. Certificates in good standing, whose application for examination has been approved, will only be required to undergo Part II of the technical examination.

6. Application is to be made to the nearest District Inspector, Civil Aviation, on the form prescribed for Application for Air Engineer's Certificate and is to be accompanied by letters of reference or other satisfactory documentary proof of the applicant's experience.

7. This circular should be read in conjunction with Information Circular T/20/38 dealing with Approved Airscrew Repair Shops, which becomes effective 90 days after date of promulgation.

Persons employed as responsible inspectors in existing shops where airscrew repair is done should make application as soon as possible so that licences may be issued to meet the immediate necessities of the industry before the expiration of the 90 day period.

**T/20/38**

**8/9/38**

### **AIRSCREW REPAIR SHOPS**

#### **(Fixed Pitch Single Piece Wooden Airscrews are not Affected by the Following Notice)**

1. An airscrew is considered to be a major component of an aircraft and, as such, requires the attention of qualified specialists. Consequently, the major overhaul of an airscrew for an aircraft having a Certificate of Airworthiness may only be done at an airscrew repair shop which has been approved by the Department of Transport in respect of the model of airscrew in question.

2. The operations, all or any of which constitute a major overhaul or repair, are:—

- (i) Assembly of new parts requiring fitting or machining operations.
- (ii) Rectification of distorted blades within cold straightening limits.
- (iii) Twisting blades of one-piece metal airscrews.
- (iv) Grinding, polishing and trimming blades.
- (v) Inspection of blades by the aid of the etching or anodic process.

3. The requirements for an approved Airscrew Repair Shop are:—

- (i) Qualified personnel, including at least one person licensed by the Department, to certify the airworthiness of an airscrew after overhauls and repairs. The rules governing the issue of such a licence are published in Information Circular T/19/38.
- (ii) *Equipment*:
  - (1) Balancing stand with knife edge and arbor with suitable mandrels.
  - (2) Propeller surface table and mandrels.
  - (3) Supply of crocus cloth.
  - (4) Riffle files.
  - (5) Drilling machine with full set of drills.
  - (6) A supply of lead wool, and tools suitable for removing and repacking lead wool.

- (7) A supply of caustic soda and nitric acid.
  - (8) Precision calipers, for measuring thickness of blades.
  - (9) Bevel protractor for measuring angle of bend in propeller blades.
  - (10) Suitable tanks in which to etch propeller blades.
  - (11) Suitable press for straightening propeller blades cold.
  - (12) Suitable twisting bars.
  - (13) Magnifying glasses for inspecting for cracks, 4-6 power.
  - (14) Portable power grinder and buffer with grinding wheel.
  - (15) Means of placing manufacturer's identification numbers and date of repair on blades so that disassembly is unnecessary at the time of inspection.
  - (16) Large accurate protractor suitable for measuring pitch angles of propeller blades together with parallel blocks for raising same as required to cover the range of blades to be overhauled.
  - (16-A) A toolmaker's surface gauge of proper size for measuring face and edge alignment together with toolmaker's combination square, graduated in 50ths of an inch.
  - (17) Necessary gauges and alignment plugs to suit the propeller hubs and blades being overhauled.
  - (18) Necessary spline adapters for range of propellers to be overhauled.
  - (19) Cadmium plating equipment installed or readily available.
  - (20) Magnetic or similar inspection equipment installed or readily available for inspection of hubs, spiders, etc.
  - (iii) Possession of complete drawings and technical instructions from the manufacturers of the airscrews.
  - (iv) Suitable quarters adequately ventilated, heated and lighted, including a store properly arranged to ensure the segregation of parts and materials.
  - (v) An organized system of keeping records of all work.
4. Approved airscrew repair stations are not empowered to do work involving annealing or other heat treatment without specific extra authority, which may be obtained by application to the nearest Department of Transport Resident Inspector, A.I.D., and on the production of proof that suitable equipment, technical instructions and trained staff are available.
5. An applicant for the Department's approval for an Airscrew Repair Shop is requested to adopt the following procedure:—
- (i) Conclude negotiations with the manufacturer of the model of airscrew for which approval is desired.
  - (ii) Set up the plant and equipment specified in Paragraph 3 and any additional equipment specially demanded by the airscrew manufacturer.
  - (iii) Engage as Chief Inspector a person licensed by the Department to certify the airworthiness after overhaul of the particular type or types of airscrew involved in the application for approval.
  - (iv) Apply to the nearest District Office, Civil Aviation, for inspection and report by the Resident Inspector, A.I.D., who will forward the application with his report to the Headquarters of the Department.
6. After 90 days from the date of this notice an Air Engineer must not certify as airworthy an aircraft fitted with an airscrew which has undergone overhaul or repairs as described in Paragraph 2, unless the airscrew has been certified to be airworthy by the Inspector of an approved Airscrew Repair Shop.



The following aircrew Repair Shop has been approved by the Department of Transport:—

<i>Name</i>	<i>Type of Airscrews</i>	<i>Authorized Inspector</i>
Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, P.Q.	Hamilton Standard (all models); Fairey Reed (fixed pitch); Curtis Reed (fixed pitch)	F. Dando

T/21/38

8/9/38

### LIGHT ALLOY AIRSCREWS—SERVICE RECORD

1. Because of the limit of life of light alloy aircrew blades, beyond which the likelihood of failure by fatigue becomes ever more present, aircraft owners or operators are required, as from October 15, 1938, to keep separate records of the service history of metal airscrews. These records are to contain such information as the source and date of supply, inspections, repairs, tests, overhauls, dismantling, etching, balancing, as well as the actual length of service in flying hours.

2. A suggested form suitable for the keeping of the required records is shown below.

Sheets of this form should be kept in a bound book of robust construction.

3. The following rulings will apply to airscrews for which records have not in the past been kept:—

- (i) A metal aircrew in service in Canada will be debited with as many hours service as the aircraft on which it is fitted, unless the owner can prove otherwise.
- (ii) An aircrew transferred from one aircraft to another will be debited with as many hours as the sum of the hours for all aircraft on which the aircrew has been installed, unless the owner can prove otherwise.
- (iii) The length of service as determined by the foregoing rulings or by the owner's records will constitute the initial entry in the log book when the keeping of records becomes obligatory.

4. The airworthiness of an aircrew transferred from one aircraft to another must be established by the previous life record as well as inspection by a licensed air engineer at the time of the approval.

5. Used metal aircrew blades and hubs obtained from the U.S.A. will not be considered as airworthy, unless the life record can be substantiated.

The United States regulations governing the export of aircraft and equipment recognize complete airscrews as class one units, requiring a Certificate of Airworthiness for Export. Aircrew components are class two units, the condition of which may be certified by the Bureau of Air Commerce Inspection Tag 186. Before Tag 186 can be attached, however, the United States authorities require a statement in affidavit form of the total life of a used aircrew and the service time since last overhaul. The Canadian purchasers are advised to insist upon a copy of this affidavit from the source of supply.

6. When an aircrew is installed on an aircraft the log book of the aircrew is to be kept in company with the log book of the aircraft, and it is to be produced on the request of any Civil Aviation Inspector.

7. Attention is drawn to Information Circulars T-1/37, and T-5/37.



## AIRSCREW LOG BOOK

Make.....Type.....Serial No.....

[illegible]

**T/23/38**

1/10/38

## LOG BOOK ENTRY—AIRCRAFT OVERHAUL

In order to unify the system of certification of registered aircraft after overhaul, the following procedure is to be adopted immediately:—

- (a) A log book entry is to be made giving details of work done, itemized by components.
- (b) The entry, if written by hand, is to commence at the extreme left-hand side of the double log book page, and is to extend across both pages; if typewritten on a separate sheet, the sheet is to be fixed on to the right-hand page, and a line drawn on the left-hand page under the last flight entry prior to overhaul.
- (c) The following declaration is to be added:—

"I hereby certify that all work listed has been done with certified material according to accepted practice; that all Manufacturer's Service Bulletins affecting safety have been complied with to date, that no unapproved modifications have been incorporated and that the aircraft is airworthy."

Sgd. \_\_\_\_\_  
Air Engineer "B"

**T/25/38**

28/10/38

## AERO ENGINES—RUNNING IN AND TEST AFTER OVERHAUL

## Introduction

It has been brought to the attention of the Department that there exists a great divergence of opinion and practice in the matter of "running in" and testing aero engines after complete overhaul, and so it is deemed to be desirable to lay down a few basic principles and a minimum standard which must be observed in order to ensure airworthiness.

The running in and test of an aero engine following assembly is an integral part of the overhaul procedure, therefore the operation must be done under the supervision of an air engineer having a certificate in Category "D", and the inspection release certificate is not to be signed until the full procedure has been completed.

There are two distinct objects to be achieved: first, the settling of the engine parts into their proper working order, which is effected by a careful and thorough running in at light load and low speed; secondly, to determine whether the engine performance will meet the minimum rating for its type and model and is of a satisfactory quality.

The separate operations to be performed on the test stand may be distinguished as

- Running In
- Endurance Test
- Auxiliary Test.

### **Test Equipment**

Running in and test should be conducted on a properly made test stand sheltered from the weather and affording proper facilities for servicing the engine, making the required observations and ensuring the safety of personnel. The construction of the stand should not be too rigid but should allow for a degree of flexibility, approximating that in an actual aeroplane. This is particularly important when running geared engines. While not forbidden, the use of the aeroplane itself as a test stand is to be deprecated and should only be made in emergency, as it does not afford all the facilities that can be conveniently provided with a test stand.

The following measurements must be made and recorded on the test log of all aero engines:—

- Barometric pressure
- Atmospheric temperature
- Running time
- Engine speed
- Oil inlet temperature (except wet sump engines)
- Oil pressure
- Fuel consumption
- Oil consumption

In addition, the following observations are desirable on most aero engines and essential on those of the higher B.V.E.P. ratings:—

- Oil outlet temperature
- Carburettor air temperature
- Cylinder head temperature
- Manifold pressure
- Fuel pressure

Preferably, the tests should be done with a calibrated test fan or club adjusted to absorb the rated power at the rated manifold pressure while at the same time creating a slipstream sufficient to ensure adequate cooling of the engine. The use of the airscrew off the aeroplane may be permitted when the number of engines of a given model is small, but it must be observed that the slipstream created by a "flight airscrew" is not usually sufficient to cool an engine operating without forward motion at a high proportion of its rated power. The cylinder and oil temperatures must be carefully watched, and the engine must not be operated

at full throttle for more than a few minutes at a time. A flight airscrew will not permit the engine to reach its rated speed without forward motion, and some engine makers recommend that the final part of the endurance test should be done in flight, circling the landing field in case of trouble. This may be permitted provided that the aeroplane is flown light so that the take-off may be made without employing full take-off power, which, if done prematurely, may cause serious harm to the engine.

### **Running In**

The time required for running in is to be in accordance with the published instructions of the engine manufacturer but must, under no circumstances, be less than one hour.

All time occupied in working at a speed and power below that of cruising range will be counted as running in time and will not be counted as test time.

### **Endurance Tests**

The endurance test time to be counted will include all continuous running at cruising power and above and is to be in accordance with manufacturers' instructions, but, on no account, must it be less than two hours unless the technique of disassembly and internal examination followed by final test be adopted.

During the endurance test, a rich mixture may be used but sufficient running must be done at the weakest mixture for maximum power at a given engine speed to prove satisfactory performance under this condition.

The endurance test is to be concluded with a run at full throttle or rated speed for a period of not less than three minutes.

### **Auxiliary Tests**

At the conclusion of the endurance test and while the engine is still warm, the following auxiliary tests are to be made:—

*Slow running test*—To prove that the engine will run reasonably well at a speed about 70% below rated speed.

*Vibration and Acceleration test*—To prove that the engine will run smoothly at all speeds and will open up from the slowest running speed to the rated speed within five seconds without excessive popping or periods of irregular running.

*Single ignition test*—To prove that when the engine is running at full throttle or rated speed, the drop in speed when one ignition system is switched off will not exceed five per cent.

**T/28/38**

**16/12/38**

### **FIRE EXTINGUISHERS—CARBON DIOXIDE**

The amount of liquid in carbon dioxide fire extinguishers must be carefully measured in accordance with the instructions of the manufacturer in order to avoid the danger of excessive gas pressure when the extinguisher is exposed to a high temperature, such as occurs when an aircraft is left out in the sun in summer time.

It is advisable to arrange for refilling by the authorized agents of the fire extinguisher manufacturer.



1939

T/1/39

11/1/39

### **AIRCRAFT FLYING AND POWER PLANT CONTROLS— INSPECTION**

Inspection of Flying and Power Plant Controls must be carried out separately by two competent Inspectors, (a) on a new aircraft, (b) on an overhauled aircraft, and (c) on an aircraft after repairs and replacements or adjustments have been made which affect the controls.

The Inspectors and/or Engineers responsible must make an entry in the Engine and/or Aircraft Log Books, on completion of each inspection. The final inspection is to be made immediately prior to flight.

T/2/39

12/1/39

### **D.H.87A and 87B "HORNET MOTH" AIRCRAFT DEFECTS IN MAIN PLANE TOP SPARS**

Instances have occurred in which the holes in the top main plane spars at the attachment of the front and rear flying wire fittings have elongated, and caused cracks in the underside of the spar.

All aeroplanes of the above type must be inspected immediately for this defect. For this purpose, it will be necessary to remove the external wiring lugs, open the fabric and remove the internal saddle fittings.

In the event of the discovery of a crack exceeding  $\frac{1}{2}$  inch in length, the aeroplane must not be flown until a new spar has been fitted.

In the event of the discovery of elongation of bolt holes exceeding  $\frac{1}{16}$  inch and/or cracks less than  $\frac{1}{2}$  inch in length, the aeroplane must not be flown until repairs have been carried out in accordance with the makers' instructions, as detailed in Drawing No. M.6386. Full details of the defect must be submitted to the makers in order to obtain these instructions.

Should there be no cracks and the elongation of the bolt holes be less than  $\frac{1}{16}$  inch, the aeroplane may be flown pending the incorporation of Modification No. M.6386, particulars of which can be obtained from the makers.

In any case, the above-mentioned modification must be incorporated within three months from the date of this Notice.

If the requirements detailed in Paras. 2, 3, 4 and 6 are not complied with, Certificates of Airworthiness of aeroplanes of the above type will be liable to suspension or cancellation and will not be renewed, and air engineers must not certify such aircraft as airworthy.

T/3/39

8/2/39

### **DAMAGED AIRSCREW BLADES**

It has been brought to the attention of the Department that damaged airscrew blades have been rough-straightened before shipping to a repair station.

The permissible limits of cold straightening are definite and it will be appreciated that the practice referred to in para. 1 is unsatisfactory, in that a blade which has already been bent beyond permissible limits may be, unknowingly and in good faith, rectified and certified by a repair station.

Operators are, therefore, instructed that, when an airscrew blade is bent, it must be sent to the manufacturer or approved repair station for straightening in an unaltered condition or, if for any special reason this is not possible, an accurate sketch showing the original damaged condition must be forwarded with the blade to the repair station.

T/5/39

3/3/39

## **MODIFICATIONS AND REPAIRS TO REGISTERED AIRCRAFT**

### **Air Regulations (1938)**

The attention of all concerned is directed to Air Regulations (1938), Part VIII, Para. 20 (2), which require either the owner or pilot of any aircraft registered in Canada to notify the Department forthwith of any repairs other than ordinary running repairs or replacements. Such notification should be made to the District Inspector, Civil Aviation, in whose district the work involved is being done.

### **Certification by Air Engineers**

An Air Engineer must not certify as airworthy any repairs or modifications which affect either the structural strength or performance or safety qualities of a registered aircraft, unless the work involved complies with one of the following:—

- (a) A method described in a manufacturer's repair manual.
- (b) A method described in an authoritative manual, such as the U.S. Civil Aeronautics Authority Manual No. 18.
- (c) Instructions contained in a manufacturer's Service Bulletin.
- (d) Drawings issued and approved by a qualified Aeronautical Engineer.
- (e) Drawings approved by the Department.

Work done complying with any one of sub-paras. (a), (b) or (c) above may, after completion, be certified by a "B" category air engineer without further reference to the Department other than the official notification mentioned in para. 1. If, however, there is any doubt whether the work is adequately and accurately described in the manuals or bulletins, the matter is to be referred to the nearest District Inspector, Civil Aviation, for a decision.

A qualified Aeronautical Engineer is one who is eligible by reason of his experience in aeronautics to be either a member or an associate member of a recognized professional body of engineers, and who is capable of professional responsibility for the drawings, calculations, tests and engineering reports necessary to substantiate the airworthiness of the repair or modification. Copies of all such drawings, calculations, tests and reports must be subsequently submitted to the Department for confirmation, together with a certificate signed by the aeronautical engineer. This certificate is to guarantee the accuracy of any calculations and/or results of tests submitted with the drawings, and certify compliance with specified airworthiness standards.

Drawings dealing with repairs or modifications to individual registered aircraft and submitted for approval by the Department should be forwarded to the nearest District Inspector, Civil Aviation.

### **Log Book Entries**

Full particulars of all work done, reference to either any repair manual or Service Bulletin used, or the drawing numbers of any



approved drawings forming the basis for airworthiness certification, must be given in the aircraft log book by the responsible air engineer before completing the certification called for in Information Circular T/23-/38.

### **Repairs to Damaged Spars**

In the case of a *repair* to a damaged spar, unless made either under the supervision and instructions of a fully qualified aeronautical engineer, or in accordance with a manufacturer's Service Bulletin, complete information and drawings must be submitted to the Department for final approval even if the method adopted follows that recommended in an accepted repair manual, and no airworthiness certification should be made by the responsible Air Engineer until final approval of the drawings has been given.

**T/7/39**

**14/3/39**

## **APPROVAL OF SKI INSTALLATIONS**

### **General**

1. In continuation of Information Circular No. T/9/38, dated March 15, 1938, the design of aircraft ski installations must conform to the limitations imposed on the axle overhang and the pedestal height by the general approval of the aircraft structure for use with skis.

### **Aircraft Conforming to an Approved Canadian Type**

2. For an aircraft conforming to an approved Canadian Type, as a skiplane, each subsequent type ski installation must be checked against the limitations imposed by the design loading conditions used in approving the undercarriage and main structure, and on which the type approval for use with skis is based. In the absence of the original strength calculations, applicants are advised to ensure that the maximum bending moment on each axle, due to either the specified vertical reactions or the side load on the ski, does not exceed the maximum bending moment produced when wheels are used. Otherwise, the manufacturer responsible for the type aircraft design must be consulted and his concurrence obtained in the geometric lay-out of the proposed ski installation.

For aircraft conforming to a Canadian Type whose approval does not include use with skis, the first type ski installation will necessitate satisfactory evidence being produced that the main undercarriage and remainder of the aircraft structure are adequate in strength to withstand the ski loading conditions specified for Canadian civil aircraft.

### **Aircraft Imported into Canada on a Type Certificate of Airworthiness for Export, Issued by the Authorities of Either the United Kingdom or Another Country Within the British Empire**

3. For an aircraft either imported in the whole state into Canada or assembled in Canada from approved parts, and for which the Canadian Certificate of Airworthiness derives from a Type Certificate of Airworthiness for Export issued by the authorities of either the United Kingdom or another country within the British Empire, and not approved as a skiplane, before the first type ski installation can be approved, evidence must be produced that the undercarriage and main structure are capable of withstanding the stresses induced by the loading conditions specified in the Canadian ski requirements for Civil Aircraft.

If the aircraft as a skiplane is included in the type approval, the same procedure as that laid down in the first part of paragraph 2 above should be followed for each subsequent type ski installation.



**Aircraft for Which the Canadian Certificate of Airworthiness Derives  
from a Type Certificate of Airworthiness for Export  
Issued by the United States Authorities**

4. Regarding an aircraft for which the Canadian Certificate of Airworthiness derives from a U.S. certificate of airworthiness for Export, for limitations imposed on each axle overhang and pedestal height are now usually given in the appropriate Approved Aircraft Specification issued by the U.S. Civil Aeronautics Authority. For the convenience of ski manufacturers and aircraft operators, the limitations affecting some of the more well known aircraft are quoted in the attached list. Limitations regarding aircraft not quoted may be obtained from the nearest District Inspector, Civil Aviation, and if not limiting figures are given in the appropriate Approved Aircraft Specification, the design procedure explained in the first part of paragraph 2 above should be followed.

It must be distinctly understood that any aircraft imported into Canada on a U.S. Certificate of Airworthiness for Export must not be operated on skis unless the appropriate U.S. Approved Aircraft Specification expressly states either that the type is eligible for export as a skiplane or that the structure complies with Canadian requirements for ski installation. In some cases, the latter statement is based on certain conditions, and these conditions must be complied with if a Canadian Certificate of Airworthiness is required for the aircraft as a skiplane.

**Aircraft Imported from Foreign Countries Other than the United States**

5. No aircraft which can be classified under this title is eligible for use on skis in Canada unless the Certificate of Airworthiness issued by the foreign authorities expressly states that the aircraft complies with Canadian ski requirements for Civil Aircraft. Unless certain limitations are quoted, the same procedure, as explained in the first part of paragraph 2 above, should be followed for each type ski installation.

# Aircraft Approved by the United States Authorities and Eligible for Use with Skis

Aircraft	Limitations
Aeronca K and Ks.....	Ski and Pedestal height of 10 ins. or less.
Aeronca KC, KCA, KM, KF, 50M, 50F, 50L.....	Ski and pedestal height of 12 ins. or less.
Beechcraft D17R.....	Maximum pedestal height 17 ins.—tread the same as the landplane.
Beechcraft D17B and E17L....	
Beechcraft D17S.....	
Beechcraft F17D.....	
Beechcraft 18D.....	Tread 12 ft. 11 ins.—distance from ski bottom to V-Brace attachment to strut not more than 48.5 ins., with gear in half deflected position.
Cessna C34.....	Ski and pedestal height of 8.5 ins. or less.
Cessna C 37.....	Ski and pedestal height of 9 ins. or less.
Luscombe 8.....	Ski and pedestal height of 10 ins. or less—tread not more than 75 ins.
Piper J4.....	Ski and pedestal height not to exceed 8½ ins. Maxi- mum ski overhang 3-7/16 ins. from outer face of brake plate to intersection with ski centre line.
Taylorcraft 130, BF and BL....	Ski and pedestal height 10 ins. or less. Tread not more than 72 ins. Ski overhang 5.16 ins. from centre of bolt attaching diagonal streamline member to axle.
Taylorcraft A.....	Ski and pedestal height 12 inches or less.
Waco AQC-6.....	Ski and pedestal height 13 ins.—tread 85½ ins. (The Department will accept pedestal height 2 or 3 ins. above the C.A.A. limit of 13 ins.)
Waco YQC-6.....	
Waco ZQC-6.....	
Waco YKS-7.....	Ski and pedestal height 13 ins.—tread the same as for wheels. (Pedestal height 2 or 3 ins. above C.A.A. limit is acceptable to the Department.
Waco ZKS-7.....	
Waco ZGC-7.....	Ski and pedestal height 14½ ins. and maximum tread 97½ inches.
Waco DGC-7.....	
Waco EGC-7.....	

**T/8/39**

**14/3/39**

**SERVICE BULLETINS ISSUED BY AIRCRAFT AND AERO  
ENGINE MANUFACTURERS**

Manufacturers of aircraft and aero engines often issue instructions regarding necessary modifications or changes to their products, these instructions being in the form of Service Bulletins which are made available to all concerned. It may be presumed, on receipt of any Service Bulletins, that the modifications or changes in question have already received concurrence from the authorities responsible for the approval of the type design affected by the modifications or changes.

The Department cannot undertake to republish manufacturers' Service Bulletins, and in order to ensure, as far as possible, that such instructions affecting Canadian owners of equipment are observed, all overhaul and repair shops and owners are advised to file their names with manufacturers of equipment with which they are concerned for receipt of Service Bulletins.

In addition, when changes of ownership of equipment occur, the new owners are strongly recommended to take similar action.

**T/9/39**

**24/4/39**

**AIRCRAFT SLINGING OPERATIONS**

During recent slinging operations of an aircraft, the rear lifting lugs failed soon after hoisting, and there is no doubt that the cause of failure was due to using a sling, the dimensions of which were less than those of the gear for which the attachment fittings were designed.

It is strongly recommended that, when slinging any aircraft fitted with slinging attachments, a slinging gear either provided by the aircraft manufacturer, or one of similar dimensions should be used, so that the design loads in the slinging attachments and main structure may not be exceeded, and possibilities of failure in any part may be obviated.

**T/10/39**

**18/5/39**

**D.H. 60 "MOTH" AND D.H. 82 "TIGER MOTH" AIRCRAFT  
SAFETY PINS IN DUAL CONTROL SYSTEM**

Reference: British Air Ministry Notice No. 11, 1939.

It was pointed out in Information Circulars T/20/34 and T/27/38 that the safety pins which secure the connecting rod between the front and rear rudder bars in the D.H. 60 "Moth" can be displaced, allowing the connecting rod to become uncoupled. This has been found to apply to the D.H. 82 "Tiger Moth" also.

These safety pins must be replaced either by split pins and washers as shown in Drawing No. M5803 or by a spring-loaded locking catch as shown in Drawing No. M6533. These drawings and the parts required to make the modification may be obtained on application to the De-Havilland Aircraft of Canada, Limited, Toronto.

This modification must be embodied within two months after the date of this Information Circular. After the expiration of this two months' period, Certificates of Airworthiness of the aircraft concerned will be liable to suspension or cancellation, and air engineers must not certify D.H. 60 "Moth" and/or D.H. 82 "Tiger Moth" aircraft as fit for flight unless the modification has been satisfactorily incorporated.

Operators of these types of aircraft who find it necessary to change frequently from dual to solo will generally find it more convenient to employ the spring-loaded locking catch, rather than the split pin and washer.

Information Circulars T/20/34 and T/27/38 are hereby cancelled.



T/11/39

6/6/39

## METAL AIRSCREWS

The following airscrew blades and hubs have been listed by the Civil Aeronautics Authority, Washington, as not airworthy for use on aircraft, and aircraft on which such airscrews are fitted are not to be considered airworthy after thirty days from the date of this notice: (Superseding all previous lists).

Manufacturer	Model	Approval No.	Serial Nos.
Curtiss (blade).....	32909	2-70	M568, M672.
" .....	33570	132	2338.
" .....	33570-63	132	2344.
" .....	55503	186	M5009.
Ham. Std. (blade).....	A1C1	308	14522.
" .....	5B1	314	18643, 27346, 27347, 34940, 34941, 37127, 41997, 41998.
" .....	11C1-4	326	22807.
" .....	25V2	352	22741, 22742, 35837, 35838, 78197.
" .....	1027-X	312	9672, 9789, 14168, 14169.
" .....	1101	2-61	11253.
" .....	1103	2-61	11518, 11519.
" .....	H1105	2-61	12738.
" .....	H1207	296	11182, 11183, 11187, 11188, 11189, 11636.
" .....	1219	296	14832.
" .....	H1221	298	12542, 12543, 15290, 38213, 38214, 39628.
" .....	1519	314	2801, 2943, 2944, 3071, 3076, 3284, 3626, 5688, 7372, 7373, 8316, 10642, 10779, 10780, 10862, 13972, 19940.
" .....	1546	314	15869, 16457, 16458, 17632, 17935, 18046.
" .....	1548	314	17935.
" .....	1605	348	12129, 12130.
" .....	1611	326	9049, 9050.
" .....	1823	340	14690, 14691.
" .....	1825	340	14591.
" .....	1827	328	16969, 16970, 17235, 17236.
" .....	1875	314	17141, 17142.
" .....	1915	306	13707.
Ham. Std. (hub).....	1518	187	1182, 1197, 1300, 4007, 4015, 4039, 4510, 4665, 4843, 5027, 5037, 5175, 5392, 5582, 7075.
" .....	1595	207	4780, 6907, 7255, 7356, 8269, 9786, 23768, 24991.
" .....	1667	213	4923.
" .....	1693	193	6933, 7356, 8814, 8815.
" .....	5006	196	8849, 9035.
" .....	5109	2-62	5199.
" .....	5131	198	16881, 16487.
" .....	7005	227	12769, 14430.
" .....	7029	239	12469, 13586.
" .....	S-8460-N	207	22634.

**REDUCTION OF FIRE HAZARD IN AIRCRAFT ENGINE NACELLES****Forward**

1. The Douglas Aircraft Company, Incorporated, in the United States have kindly given the Department permission to publish the contents of their Report No. 2323 dealing with tests conducted by the Company with the object of reducing the probability of aircraft nacelle fires and the damage resulting therefrom. The scope of the investigation includes flexible hose type connections, suspension and location of oil-tanks, mechanical controls forward of the firewall, electrical conduit and hydraulic tubing forward of the firewall and semi-automatic shutoffs for all inflammable fluids.

2. The Department does not propose to publish the complete report but will confine the contents of the succeeding paragraphs to the introductory remarks and conclusions and recommendations made by the Douglas Aircraft Company. Any further information, such as the description of tests, may be obtained on application to the Department.

**Introductory Remarks on Tests**

3. Emphasis has been placed on preventing the growth and spread of a nacelle fire by the diminution of the possibility of feeding the fire with fuel, lubricating oil, and hydraulic fluid after the fire breaks out.

The use of a fire warning system to indicate to the pilot the fact that a fire is present is undoubtedly of the utmost importance. Considerable thought has been given to the method by which this could be accomplished but no method which the Douglas Company considers satisfactory has been developed at the present writing. This report will therefore not concern itself with methods of fire detection but will consider only the means for prevention of the spread of a nacelle fire after it has once started. It will be obvious from the solutions offered that the proposals made will greatly diminish the possibility of nacelle fires getting started.

The investigation reported herein has not concerned itself with such items of protection as stainless steel inner cowl, revisions of the fire extinguishing system, and other items of fire prevention and control.

**Conclusions and Recommendations****4. (a) Hose Clamps**

It is essential, if a hose clamp is to be useful at the high temperatures occurring under conditions of nacelle fire, that the clamp material be free from any points of high stress due to peculiarities in its design. At least two types of clamp were found to be satisfactory. Certain other types, such as those having rectangular holes punched in the strap for the purpose of size adjustment, were found to be definitely unsatisfactory when fire was applied.

Tests to determine the effect of the angular position of the clamp with respect to the direction from which the fire was applied indicated that it will not be necessary to specify the actual position of the clamp on the hose, and that this position can be determined by the assembly mechanic for the greatest ease in assembly.

#### *(b) Hose Connections*

On the basis of fire tests, with hot oil circulating through the fittings, and with vibration present it was found that a certain type of hose covered by a wrapped shield consisting of two layers of .015 in. flexible Mica sheet was the most satisfactory.

The type of hose consists, according to information received from the manufacturer, of Neoprene with asbestos impregnation, and includes a spiral wrap of stainless steel wire as part of the reinforcing material. This type of hose is considerably stiffer than the standard Neoprene hose now used, but is considered satisfactory as a flexible joint. Because of its increased body and stiffness, it appears that it will be necessary for the manufacturers of this hose to hold an extremely close tolerance on the inside diameter in order that proper fit on the tubing can be made.

#### *(c) Oil-tanks*

The tests indicated that an oil-tank, if located forward of the nacelle firewall, should be supported by steel rather than aluminum alloy straps. It was found that the portions of the tank which were in contact with the oil within the tank remained intact during a simulated nacelle fire; the portion of the tank above the oil level was almost completely burned away in localized spots of high intensity flame.

#### *(d) Mechanical Controls Forward of the Firewall*

It was indicated that small control cables ( $\frac{3}{32}$ " or under) even though they be made of stainless steel, will part in a nacelle fire. Apparently the only safe material is stainless steel rod, preferably  $\frac{1}{8}$ " in diameter or greater. It is therefore recommended that such mechanical controls as must be operative during a nacelle fire be made of stainless steel rod where they exist in the nacelle forward of the firewall.

#### *(e) Electrical Conduit and Hydraulic Tubing*

No aluminum alloy conduit can be depended upon to protect the electrical wire therein under conditions of nacelle fire. Tubing carrying fluids will withstand fire so long as the tube is full of fluid. Nothing other than steel tubing can be recommended to withstand a nacelle fire when the tubing is dry. It is, therefore, recommended that fire extinguisher lines forward of the firewall be made of steel tubing.

#### *(f) Shutoff Valves*

The Douglas Company fire control shutoff valve, part number 5080649, was found to be satisfactory in its operating characteristics.

5. The Douglas Aircraft Company state that it is their policy to make known to any interested parties, be they aircraft manufacturers, airline operators or governmental agencies, any and all tests and developments which in their opinion definitely contribute to the safety of aeronautical transportation. The Department gratefully appreciates this attitude and acknowledges with many thanks permission of the Douglas Aircraft Company to publish the contents contained in this Information Circular.



**T/13/39****29/6/39****GENERATOR AND CONTROL BOX CIRCUITS**

It has transpired that certain persons are installing a switch in the field circuit of the generator control box system in order to make it possible to stop the generation of current at will. When such a switch is installed it must on no account be connected to ground as such a connection may introduce a serious risk of fire. The switch should be installed as an interruption of the field circuit.

**T/14/39****22/7/39****AERO ENGINE SERIAL NUMBERS**

The serial number of an engine is not to be changed even though that part of the crankcase which, as a matter of convenience, bears the number plate is replaced.

The serial number of an aero engine is the most important clue to the date of manufacture and the details of the materials and construction of the components embodied in the engine. Service Bulletins and similar documents introducing changes usually contain a reference to serial numbers.

The old number plate is to be removed from the old rejected crankcase part and affixed to the new part, and the letter "A" is to be stamped after the serial number to indicate that such a change has been made. Details of the new crankcase part with its own serial number, if any, are to be entered in the engine logbook. Should it ever be necessary to repeat the change, the letter "A" is to be struck out and the letter "B" stamped on and so on.

**T/15/39****22/7/39****FIRE PREVENTION—WACO AIRCRAFT**

Operators of Waco Aircraft fitted with Jacobs Engines of the L5 or L6 types are advised that a case has occurred recently of the destruction of a Waco aircraft by fire, while attempting to start the engine.

It is considered that a possible cause is the opening of the carburettor heat valve when starting up, and it is suggested that the practice be adopted of keeping this valve closed, so shutting the carburettor heat fully off until after the engine has been run up and the aircraft is ready to take off.

**T/16/39****17/8/39****STROMBERG NA-S2—CARBURETTOR**

A recent failure of an engine was traced to a loose needle valve seat. The seat is a bronze insert screwed into the base of the float chamber.

No provision is made for safetying the old pattern seat in place and, therefore, it is liable to work loose and ultimately bind the carburettor float in such position that the fuel supply is cut off.

All operators and owners using this type carburettor are advised that a modified needle valve seat Part No. P-19694 is available which is provided with a safety locking arrangement. This type of seat should be fitted at the earliest opportunity.

Stromberg type NA-S2 carburettors are fitted to the following engines:—

Continental—A40, A40-2, A40-3, and A40-4.

Aeronca—E-113—A, B, and C.

E-113—CD

E-113—CDB

E-113—CB

Franklin—4AC-150 Series 50, and 4AC-150 Series 40.

Lycoming—O-145—A1, A2, A3, C1, C2 and C3.

**T/17/39**

**22/8/39**

### **TAYLOR CUB AND PIPER AIRCRAFT—FUEL LINE**

Failures of fuel line in the above types of aircraft have occurred due to wear where the line passes through the fire wall.

Frequent inspection at this point is recommended. If a rubber grommet is fitted at the opening in the fire wall it should be removed to facilitate examination. If damaged, the fuel line should be replaced and the fire wall cut away to prevent contact.

The manufacturer of the aircraft has been requested to prepare a modification but in the interval pending their instructions this point should be closely watched.

**T/18/39**

**18/8/39**

### **LOG BOOK ENTRY—AIRCRAFT INSPECTIONS**

Further to Information Circular No. T/23/38; when an aircraft has undergone examination for airworthiness with a view to applying for renewal of Certificate of Airworthiness, and no work is found necessary, the following log book entry may be signed by the "A" or "B" category Air Engineer making the inspection:—

"I hereby certify that all Manufacturers Service Bulletins affecting safety have been complied with to date, that no unapproved modifications have been incorporated, and that the aircraft is airworthy."

Signed.....  
Air Engineer, Certificate No. ....

**T/19/39**

**20/12/39**

### **HAMILTON STANDARD PROPELLERS**

**(Blades 6095A, 6167A, and 6101A—Direct Drive  
Wasp Engine Blade Vibration)**

During the last few years, an occasional tip failure with the 6095A blade design has been experienced on the direct drive Wasp engine. In practically all cases, the focal point of the fatigue failure was a severe nick in the blade. The method developed by this Company of measuring propeller stresses has been applied to an investigation of this condition, and it was found that the 6101A blade design resulted in a somewhat lower stress. This has been borne out in service.

The aerodynamic performance of these two blade designs is very nearly identical and may slightly favour the somewhat heavier 6101A design. A recent flight test indicated 1.3 MPH increase in top speed with the 6101A design and a 50-foot reduction in the take-off distance required to clear a 50-foot obstacle.

It is, therefore, recommended that the 6101A blade design should be substituted for the 6095A and 6167A designs on all direct drive Wasp engines in service. This replacement should be accomplished as soon as practicable, but continuation in service of the present blades until the next overhaul, if necessary, is considered satisfactory.

A further reduction in propeller tip stress can be obtained on the "H" Wasp direct drive engine in combination with the 6101A blade by the use of both 4 $\frac{1}{2}$  and 9th order dampers in the crankshaft. This damper combination is installed in current production engines and can be installed in older engines.

As this damper combination results in a tip stress reduction on the "H" Wasp engine, it is urged that all operators contact Pratt & Whitney Aircraft Division and obtain the necessary conversion parts.

In order to assist operators in replacing 6095A and 6167A blades with the 6101A design, Hamilton Standard Propellers is preparing to allow credit on serviceable blades on the basis of 3,000 hours' life expectancy.



## APPENDIX

### AIR ENGINEERS' CERTIFICATES

#### CONDITIONS OF ISSUE AND INSTRUCTIONS TO APPLICANTS

##### DEFINITIONS

"Minister," in these instructions, means the Minister of Transport.

"Air Engineer," in these instructions, means a person who is the holder of an Air Engineer's Certificate issued by the Minister of Transport authorizing him to act as therein specified.

##### CATEGORIES

Air Engineers' Certificates will be issued subject to the provisions of Air Regulations, for any or all of the following purposes:—

"A"—Inspection of aircraft before flight.

"B"—Inspection of aircraft after overhaul.

"C"—Inspection of aero engines before flight.

"D"—Inspection of aero engines after overhaul.

##### QUALIFICATIONS

In order to qualify for an Air Engineer's Certificate, a candidate must,

- (a) Be a British subject, or a subject of a foreign country which grants reciprocal aeronautical privileges to Canadians on equal terms and conditions with subjects of such foreign country.
- (b) Not be under 19 years of age.
- (c) Satisfy the Minister by examination or otherwise as to his ability.
- (d) Be able to demonstrate sufficient ability in the use of appropriate tools and materials that would be necessary to enable him to perform such repairs and replacements as his duties in maintenance of aircraft and/or aircraft engines might require.
- (e) Furnish three names and addresses of either
  - (i) employers engaged in the manufacture of aircraft and/or aircraft engines; or engaged in the operation of aircraft.
  - (ii) licensed air engineers who can, from personal knowledge, vouch for the proficiency of the candidate in practical aeronautics.

##### EXPERIENCE

"A" Candidates for certificates in category "A" will be required to submit proof of having had at least two years' satisfactory experience both on aircraft construction and maintenance, or on maintenance alone.

"B" Candidates for certificates in category "B" will be required to submit proof of having had at least two years' satisfactory experience both on aircraft construction and maintenance, or on construction alone.

"C" Candidates for certificates in category "C" will be required to submit proof of having had at least two years' satisfactory experience both on aero engine construction and maintenance, or on maintenance alone.

"D" Candidates for certificates in category "D" will be required to submit proof of having had at least four years' satisfactory experience both on aero engine construction and maintenance, or on construction alone.

In all categories Certificates will be limited to those types of which the candidate has experience.

## SCHOOL TRAINING

Time spent at technical schools or like institutions may be taken under consideration when assessing experience, and may be permitted to count towards the experience required for an Air Engineer's Certificate under the following conditions:—

- (a) A student having completed an Air Engineer's course at a technical school or like institution may, on graduation from the school, be credited with the actual hours spent in the aircraft and aero engine shops of the school on practical work. Such time may not exceed a credit of one year, and will apply on "A" and "C" licences only.
- (b) A certificate of competency relative to the candidate's qualifications will be accepted from a licensed engineer in the employ of such school and the hours of practical shop work should be verified by the principal or his assistant.
- (c) The balance of the two years' experience required for an Air Engineer's Certificate must be completed in full on actual operations under the supervision of a licensed air engineer.
- (d) No part of any school work will be admitted as qualifying a candidate for categories "B" or "D."

## APPLICATIONS FOR CERTIFICATES

Application forms may be obtained on request from Civil Aviation Inspectors at the various District offices, or from the Civil Aviation Division, Department of Transport, Ottawa.

Applications for Certificates cannot be considered unless sufficient information is given in either the application or letters of competency concerning the candidate's experience on different makes and models of aircraft and aero engines. Complete details are required, both in the application and letters of competency, stipulating the length of time connected with the aircraft industry on maintenance and/or construction duties and specifying the makes and models on which satisfactory work has been done.

Air Engineers may, from time to time, be examined on additional types, and if the examination is satisfactorily passed, the Certificate will be endorsed accordingly. Such examinations may be either oral or written, at the discretion of the examiner.

## EXAMINATIONS

*Category "A"*—Inspection of Aircraft before flight.—Applicants must be familiar with the general principles of the systematic maintenance and examination of aircraft before flight, including knowledge of:—

- (a) The method of checking the correct assembly of components, the rigging of an erected aircraft and the functioning of the flying controls, together with the correction of faults experienced during flight, the assembly and functioning of the landing gear including the correct rigging of skis, and the method of erection, truing up and maintenance of hulls and floats of wood, metal, or composite construction.
- (b) The defects and deterioration in wing coverings, timber and metal members, metal fittings, airscrews (wood or metal), streamline wires, tie-rods, cables, shock absorbing devices and other parts of the aircraft structure that may be expected to occur as the result of wear and tear, or may be produced by slight mishaps experienced during normal operations of the aircraft, and a knowledge of the method of effecting minor repairs and replacements.
- (c) The method of inspecting and testing the installation of the flying instruments to ensure correct functioning.
- (d) Compass adjustment, turn indicator, and electrical services, the method of inspecting and testing of the installation concerned in order to ensure correct functioning.



- (e) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.
- (f) The entries which must be made in the appropriate log book, and ability to select data and to make other suitable entries to provide a useful history of the aircraft.
- (g) Air Regulations in so far as they affect Air Engineers.

*Category "B"*—Inspection of Aircraft after overhaul.—The applicant must be familiar with the general principles of the inspection of aircraft construction, including knowledge of:—

- (a) Non-Metallic materials and their relative specifications; methods of identification, examination and testing; characteristic defects which render them unsuitable and precautions to be observed in their application to aircraft construction.
- (b) Metallic materials and their relative specifications, methods of identification, examination and testing; characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture or repair—(heat treatment, welding, brazing, soldering, plating, etc.).
- (c) The method of construction and examination of hulls and floats; effects of corrosion, causes of corrosion and protection against corrosion.
- (d) The method of construction, examination and testing of aircraft parts and components—(fuselages, wings, airscrews, tanks, radiators, pumps, cocks, etc.) corrosion and its prevention.
- (e) The high tensile steels, strong aluminum alloys, etc., and the special workshop processes applicable to the materials used in the particular construction or constructions.
- (f) Method of inspecting and testing the complete aircraft for correct assembly, installation of engine, controls, fuel, oil and water systems, cabin heaters, instruments, electrical services and other appliances.
- (g) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.
- (h) The entries which must be made in the appropriate log book, and ability to select data and to make other suitable entries to provide a useful history of the aircraft.
- (i) Air Regulations in so far as they affect Air Engineers.

*Category "C"*—Inspection of Aero Engines before flight.—The applicant must be familiar with the general principles of inspection and testing of aero engine installation and maintenance, including knowledge of:—

- (a) The general construction of the particular type or types of engine for which the Certificate is required, together with the running time permissible before overhaul; the method and details of making a partial overhaul for the purpose of carbon removal, valve grinding and inspection, the defects likely to be encountered and the permissible allowances for wear and distortion; the methods of inspection and testing during and after this operation to ensure correct assembly and functioning.
- (b) The methods of examining and testing the correct erection of the power plant and its accessories in the aircraft, including the fuel, oil, cooling, ignition, induction and exhaust systems, tanks, pipe lines, engine controls, airscrew complete with hub, together with characteristic defects.
- (c) The inspection, adjustment and testing of the power plant and its accessories to ensure correct functioning and power output after installation in the aircraft and during daily maintenance, including airscrews, magnetos, carburettors, pumps, filters, engine starters and starting mechanisms and other parts or components on whose condition the correct functioning of the power plant depends; causes, effect, and prevention of external and internal corrosion.



- (d) The correct grades of oil and other lubricants approved by the engine manufacturer for use on the particular engine or engines and their seasonal application; periods of running between oil changing.
- (e) The minimum requirements for the fuel as specified or recommended by the engine manufacturer.
- (f) The methods of inspecting and testing the installation of the instruments connected with the power plant concerned to ensure correct functioning, including pressure gauges, temperature and revolution indicators, boost gauges and tank contents gauges.
- (g) The method or methods of starting engines in sub-zero temperatures, including precautions to be taken to minimize the risk of fire, when naked flames are used during this operation.
- (h) For certificate to include supercharged engines, the functioning of superchargers and boost control.
- (i) For certificate to include Compression Ignition Engines; the fuel injection system and method of regulation.
- (j) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.
- (k) The entries which must be made in the appropriate log book, and ability to select data for and to make other suitable entries to provide a useful history of the engine.
- (l) Air Regulations in so far as they affect Air Engineers.

*Category "D"*—Inspection of Aero Engines after complete overhaul. The applicant must be familiar with the general principles of the inspection of aero engines during construction and/or complete overhaul including knowledge of—

- (a) Materials used in engine construction and their relative specifications, methods of identification, re-examination and testing. Characteristic defects which render them unsuitable and precautions to be observed during processes of manufacture and repair—(heat treatment, white metalling, etching, brazing, soldering, protection against corrosion, etc.)—to ensure that the finished parts are in a satisfactory condition.
- (b) The general principles of testing and measurement of horse power, fuel and oil consumption, etc., as applied to aero engines.
- (c) The correct grades of oil and other lubricants approved by the engine manufacturer for use on the particular engine or engines and their seasonal application; periods of running between "oil changing"; characteristic defects resulting from incorrect or insufficient lubrication; cause and effect of sludge formation.
- (d) The minimum requirements for the fuel as specified or recommended by the engine manufacturer.
- (e) The general assembly, adjustment and methods of testing the correct erection of the components of the particular type or types of aero engine for which the certificate is required, including the safe allowances for deterioration, wear, distortion, balancing of parts, etc. The methods of adjustment, repair and testing of carburettors, engine starters, pumps, etc., that are fitted to the particular type of engine and of minor repairs to, and adjustment of, magnetos. Causes, effects and prevention of external and internal corrosion. Protection against corrosion during storage.
- (f) The methods of inspecting and checking the correct functioning of the ignition, carburation, lubrication and cooling systems on the engine during tuning up and testing.
- (g) For certificates to include supercharged engines, the method of construction, testing and functioning of the supercharger unit and its accessories.
- (h) For certificates to include Compression Ignition Engines, the construction of the Fuel Injection System and the methods of fuel regulation.

- (i) All applicable modifications contained in Technical Information Circulars issued by the Controller of Civil Aviation.
- (j) Entries which must be made in the appropriate log book, and ability to select data for and to make other suitable entries to provide a useful history of the engine.
- (k) Air Regulations in so far as they affect Air Engineers.

## PRACTICAL TEST

### *Tools and Materials*

An Air Engineer in the performance of his duties may and often will be required to execute various repairs and replacements, for which a certain amount of skill in the manipulation of materials and the use of hand tools is necessary. Candidates must satisfy the examiner that they possess the required skill for this work and may be required to demonstrate this fact by actual tests. These tests will be confined to simple operations as:—

- (a) Use of files and scrapers.
- (b) Use of measuring instruments.
- (c) Marking off and drilling, to drawing.
- (d) Bending of sheet metal and tube.
- (e) Soldering and brazing.
- (f) Use of carpenter's hand tools.
- (g) Preparation and use of casein cement.
- (h) Sewing of fabric.
- (i) Splicing of control cables.
- (j) Riveting.
- (k) Fitting of Piston Rings.
- (l) Valve grinding, etc.

(This does not imply that all repairs to aircraft must be effected by an air engineer. It is permissible for the actual work to be carried out by any competent mechanic, although the result must be passed by an air engineer holding a certificate in the appropriate category, before the aircraft can be accepted as airworthy).

## AUTHORITY

- (a) *Air Engineer's Certificate, Category "A"* authorizes the holder to certify as airworthy any of the types of aircraft endorsed on his certificate, provided:—
  - (i) That the annual Certificate of Airworthiness for the particular aircraft is in good standing.
  - (ii) That he is satisfied by adequate and personal inspection that the aircraft is airworthy at the time he records this fact in the aircraft log book.
- (b) In addition it authorizes the holder, after adequate inspection, to certify as airworthy any minor repairs and replacements which become necessary to these types of aircraft as the result of normal use.
- (c) For the purpose of this instruction minor repairs and replacements are defined as those which do not affect the strength of the main structural members of the aircraft, except that such members may be replaced only by replacing the complete assembly in which they may occur, in which case the replacement assembly must have been duly certified as airworthy by an air engineer holding the appropriate certificate.

NOTE:—(A spar is a main structural member and also forms an integral part of a main assembly. Its repair or replacement must be certified by an air engineer licensed in Category "B." A longeron forms an integral part of the fuselage and the same ruling applies to replacement of these components.



An air engineer, Category "A," may, however, certify the aircraft as airworthy after the satisfactory replacement of the complete assembly containing either of these.)

An Air Engineer, Category "B," is authorized to certify as airworthy, after major repairs or complete overhaul, any of the aircraft endorsed on his Certificate provided:—

- (a) That the aircraft conforms to the type for which the original Certificate of Airworthiness was issued, with the exception of such modifications as may have been ordered by the Minister in Technical Information Circulars issued by the Controller of Civil Aviation or otherwise approved.
- (b) That he is satisfied by adequate and personal inspection that the strength of other repaired component or components is similar to the strength of the same components when in the new state, and that such repaired components or replacements conform to the approved drawings in material and dimensions excepting:—
  - (i) That damaged portions of welded steel tube fuselages and of other components of similar construction may be replaced provided that the location and design of the welds conform to established practice for the type of repair, and that the original metallurgical structure of the material has been restored by suitable heat treatment in those components on which heat treatment is a requirement during manufacture.
  - (ii) That repairs to other forms of construction are similarly in accordance with established practice.
  - (iii) That repairs to spars and other components as may be specifically directed by Technical Information Circulars conform to sketches or drawings which have been submitted to the Minister and approved by him for each repair.
- (c) That he is satisfied by adequate and personal inspection that the aircraft has been assembled correctly including the installation or insertion of all necessary locking devices as will prevent the accidental separation of any of the components and that the protection against deterioration is reasonable for the purpose, having in mind the particular conditions under which the aircraft is required or expected to operate.
- (a) Air Engineer, Category "C," is authorized to certify as airworthy any of the types of aircraft engines endorsed in his Certificate provided:—
  - (i) That no modifications to such engines have been made except as directed by the Minister in Technical Information Circulars or otherwise approved.
  - (ii) That he is satisfied by adequate inspection that the engine is airworthy at the time he records this fact in the appropriate log book.
- (b) In addition it authorizes the holder, after adequate inspection, to certify as airworthy all minor repairs, replacements and adjustments which may be required as a result of normal operation, or become apparent during partial overhaul.
- (c) Partial overhaul is specified for the purpose of this instruction as:—
  - (i) Removal of cylinders and attached valve gears for the purpose of carbon removal, valve reseating, etc., and general inspection not requiring the complete dismantling of the engine.
  - (ii) Removal of accessory units for examination, adjustment or repair.

An Air Engineer, Category "D" is authorized to certify as airworthy, after major repairs and/or complete overhaul, any engines of the types endorsed on his certificate, provided:—

- (a) That replacement parts conform in all respects to the manufacturer's approved drawings for such parts.
- (b) That reasonable precautions against failure of any part has been taken by means of adequate inspection.



- (c) That no modifications have been made or added except as ordered by the Minister in Technical Information Circulars, or otherwise approved by him.
- (d) That he is satisfied by adequate and personal inspection, that the engine has been correctly assembled including the installation or insertion of all necessary locking devices as will prevent the accidental separation or derangement of any of the components.
- (e) That the satisfactory functioning of the assembled engine and its essential accessories has been proved by adequate ground test.
- (f) That the protection against deterioration is reasonable having in mind the particular conditions under which the engine is required or expected to operate.

### PERIOD OF VALIDITY

Certificates are issued for a period of three years.

### RENEWALS

Applicants for renewal of Air Engineers' Certificates must be prepared to produce proof to the examining official that they are in possession or a copy of all current Technical Information Circulars, and that they are familiar with same.

Technical Circulars bear a number prefixed by the letter "T" thus T/1/32, T/17/34, etc. Missing numbers may be obtained on request. Applicants must state the serial number of the last Technical Information Circular received by them.

Certificates are normally renewed for a period of three years.







